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ABSTRACT

Results of a joint meeting between national advisory councils in medicine and nursing on physician-nurse collaboration to enhance patient safety are reported. Recommendations on which participants reached consensus are organized by these Institute of Medicine (IOM) themes: establish a national focus to create leadership through research and protocols to enhance the knowledge base about safety; identify and learn from errors through immediate, strong mandatory reporting efforts; raise standards and expectations for improvements in safety; and create safety systems inside health care organizations through implementation of safe practices at the delivery level. A summary of collaborative activities follows. The issues as outlined by speakers at the meeting are organized by IOM themes. Seven manuscripts are "Putting Patients First: Improving Patient Safety Through Collaborative Education" (Wakefield); "Managing Error for System Improvement" (Kaplan, Battles); "Preventing Patient Injuries" (James); "Collaborative Education to Improve Public Safety" (Conway-Welch); "Learning to Improve Complex Systems of Care" (Headrick); "Using Clinical Computing to Enhance Physician and Nurse Collaboration and to Improve Patient Safety" (Gardner); and "Collaborative Education to Improve Public Safety" (Swankin). Three annotated bibliographies are appended: nurse-physician collaboration in practice (71 items); interdisciplinary (interprofessional) education (88); and medical errors and error prevention (79). (YLB)

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ED 468 611

Collaborative Education to Ensure Patient Safety

Council on Graduate Medical Education

National Advisory Council on Nurse Education and Practice

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Joint Meeting:

September 13-14, 2000
Washington, DC

Report to:

Secretary of U.S. Department of Health and Human Services and Congress

U.S. Department of Health and Human Services
HRSA
Health Resources and Services Administration
Bureau of Health Professions
Division of Nursing
Division of Medicine and Dentistry

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December 20, 2000

Joint Statement

We determined to identify what we can do, not just within our respective disciplines, but particularly together, to reduce medical errors and improve patient safety. This was in response to the historic report, "To Err is Human," published by the Institute of Medicine one year ago, documenting in a dramatic way that "health care" in the United States can be dangerous to your health. A prestigious panel of experts reviewed recent studies and concluded that serious errors occur in the process of patient care, resulting in tens of thousands of premature deaths each year. Many recommendations were to address these most troubling findings. And perhaps none are more important and urgent than improving the way physicians and nurses work together to improve patient safety.

The following report captures our comprehensive deliberations and recommends much needed actions and activities we consider essential to improve patient safety. However, each recommendation must be considered in the light of the following:

1) Historical Divide Between the Disciplines - Medicine and nursing often practice as two independent and parallel professions, preventing the partnership and collaboration necessary for improving patient safety.

2) Need for Systems Reform - It is a myth that health care operates as a system. Health care must be reformed to incorporate mechanisms and methods which enhance patient safety and prevent harm.

3) Need for Interdisciplinary Training and Practice - Improvements in patient safety are impossible without interdisciplinary team training and practice.

4) Multicultural Context - The increasing diversity of the nation's population mandates that patient safety education and practice be conducted in the context of cultural competency.

For these recommendations to become a reality will require leadership and commitment on all levels of the nursing and medical professions - nothing short of a revolution in how we educate and train nurses and doctors, and how we practice together.

David N. Sundwall, M.D.
Chair, COGME

Susan Johnson Warner, Ed.D., R.N.
Co-Chair, NACNEP

Collaborative Education to Ensure Patient Safety

Council on Graduate Medical Education & **National Advisory Council on Nurse Education and Practice**

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Acknowledgments

The two Councils gratefully acknowledge the contributions of the Planning Work Group whose members were drawn from both Councils. David N. Sundwall, Chair of COGME, and Susan Johnson Warner, Co-Chair of NACNEP, Co-Chaired each of the planning meetings and the Joint COGME/NACNEP Meeting. The Planning Groups defined the theme for the meeting on patient safety, planned the overall format of the meeting, and reviewed and revised this report of the joint meeting. Representatives at these meetings were Dyanne Affonso, Eileen Breslin, Marilyn P. Chow, Doreen Frusti, Judy Goforth Parker, and Sally E. Ruybal from NACNEP, and Jo Ivy Boufford, William Ching, Carl J. Getto, Kylanne Green, Ann Kempski, and Douglas L. Wood from COGME. The Councils thank Elaine G. Cohen, Executive Secretary of NACNEP, Richard Diamond, Staff Liaison to COGME, Madeleine Hess, Staff Liaison to NACNEP, and Evelyn Moses, Consultant to the Division of Nursing, HRSA, for planning the joint meeting and coordinating the preparation of this Report. We also wish to recognize Barbara Easterling, Donna English, and Terris Kennedy of the Division of Nursing for their contributions to the planning process. The Councils particularly wish to acknowledge Denise H. Geolot, Chair of NACNEP and Director, Division of Nursing, and Stanford M. Bastacky, Executive Secretary of COGME, for their leadership and guidance on the organization of the joint meeting of the two Councils and this Report.

The Councils are also indebted to several individuals whose special efforts contributed immeasurably to the success of this joint meeting. Linda Headrick served as facilitator and Carl J. Getto and Judy Goforth Parker served as recorder/reporter for the workgroup on Collaborative Education and Training to Improve Patient Safety. Reed M. Gardner served as facilitator and Douglas L Wood and Marilyn Chow as recorder/reporter for the workgroup on Collaboration in Practice and Continuing Education to Increase Patient Safety. Colleen Conway-Welch served as facilitator and William Ching and Eileen Breslin as recorder/reporter for the workgroup on Preparing Faculty to Work and Teach in a Collaborative Systems Environment to Improve Patient Safety.

The Councils also gratefully acknowledge Richard Diamond for the development of the annotated bibliographies. The Councils are deeply indebted to the many individuals who contributed to making these proceedings possible. In particular, the Councils acknowledge Richard Schmidt for his invaluable assistance in the organization and preparation of this Report and Helen Lotsikas who served as Project Officer.

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Executive Summary

This report describes the results of a joint meeting between national advisory councils in Medicine and Nursing on collaboration between physicians and nurses to enhance patient safety. It was carried out by the Council on Graduate Medical Education (COGME) and the National Advisory Council on Nurse Education and Practice (NACNEP). Both COGME and NACNEP are chartered advisory councils to the Congress and the Secretary of Health and Human Services. Under section 762 (COGME) and section 845 (NACNEP) of the Public Health Service Act, as amended, both Councils are mandated to assess the workforce trends in their respective professional bodies and recommend actions to address identified needs. The National Advisory Council on Nurse Education and Practice (NACNEP) was originally chartered in 1964. The Council on Graduate Medical Education (COGME) was established in 1986. The meeting was the second joint activity carried out by COGME and NACNEP. These two organizations undertook their first collaborative venture five years ago. That initiative focused on the interdisciplinary primary care workforce, leading to development of an analytic approach to estimating requirements for primary care providers and recommending further work toward eliminating barriers and facilitating collaboration. The results were published in December 1995 in the Report on Primary Care Workforce Projections. A second collaboration was discussed earlier this year, shortly after the Institute of Medicine (IOM) published its report: "To Err is Human: Building a Safer Health System." The report and the broad public reaction that followed its issuance prompted a joint COGME-NACNEP planning group to extend the examination of collaboration between physicians and nurses to look at "Collaborative Education Models to Ensure Patient Safety." The second Joint COGME-NACNEP meeting was held in Washington, D.C. on September 13-14, 2000. The meeting was planned to allow a free flowing debate on the issue of medical errors and to encourage discussion of new approaches that would reduce errors and enhance patient safety. Although education is the major focus of both advisory bodies, discussions and recommendations were encouraged on all relevant aspects of this important issue. The meeting produced substantive recommendations designed to foster interdisciplinary education and practice to promote patient safety, and concluded with a resolution to hold another collaborative meeting. Much as the Institute of Medicine report produced major themes related to achieving important gains in patient safety, the COGME-NACNEP meeting produced five major findings for which they suggest major changes will be required to achieve the needed improvements in patient safety.

Finding One: *Patient safety cannot be accomplished without interdisciplinary practice approaches.* Safety depends upon implementation of a unified interdisciplinary system that addresses the realities of practice and patient care. Education and practice methods must stress interdisciplinary team approaches.

Finding Two: *Patient safety gains are unlikely to be achieved at a satisfactory pace in the absence of revolutionary changes.* The more common, relatively slow evolutionary processes that tend to govern change in the health care system are considered to be inadequate to counter the present level of threat to patient safety.

Finding Three: *Current system discontinuities need to be confronted towards the aim of building a true, safety-oriented system of care.* Discontinuities exist often at the interfaces between various components of existing health care systems and significant improvements are required in the ways in which such interfaces are managed. Information has a major role to play in reducing the discontinuities and enhancing the ability of health care teams to manage successfully through the interfaces.

Finding Four: *A significant cultural change in medicine and nursing is required to achieve the needed gains in patient safety.* Culture in this instance refers to the language, ideas, beliefs, customs, codes, institutions, and tools employed by physicians and nurses in their practices. Existing professional cultural norms generally fail to support or encourage the types of changes implied by the interdisciplinary team approach endorsed herein. Further, even beyond the professional cultural norms that exist and are in need of change, the workforce itself must continue to become more ethnically diverse if the system is to be able to function

effectively for the many ethnic and cultural subpopulations that now characterize the United States.

Finding Five: *Patient safety requires that patients become acculturated in the need to participate actively in their own health care.* The current "patient culture" implies that patients generally do not question the activities and interventions considered necessary by health care professionals. Physicians and nurses must adjust their own practice approaches to encourage patients to become educated and to participate in their own health care.

To Err is Human[1] was completed by the IOM and the report issued in November 1999. The IOM study was commissioned because of the perceived apathy among all participants in the U.S. health care system, from physicians and nurses to insurers, licensing and accrediting bodies and the general public. Although the media picks up and publicizes especially tragic instances of medical errors, those cases disappear quickly, only to be replaced by other more recent events. The IOM asserts, *"The goal of this report is to break this cycle of inaction. The status quo is not acceptable and cannot be tolerated any longer."* Perhaps the most important point made by the IOM report, noted early in its Executive Summary is that, *"A comprehensive approach to improving patient safety is needed. This approach cannot focus on a single solution, since there is no 'magic bullet' that will solve this problem, and indeed, no single recommendation in this report should be considered as the answer."* Another key to the comprehensive approach discussed by the IOM is, *"Building safety into processes of care is a more effective way to reduce errors than blaming individuals . . . The focus must shift from blaming individuals for past errors to a focus on preventing future errors by designing safety into the system."* Blaming individuals does not make a safer system.

The IOM recommendations follow a four-tiered approach:

1. Establishing a national focus to create leadership, research, tools and protocols to enhance the knowledge base about safety;

2. Identifying and learning from errors through the immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts both with the aim of making sure the system continues to be made safer for patients;

3. Raising standards and expectations for improvements in safety through the actions of oversight organizations, group purchasers, and professional groups; and,

4. Creating safety systems inside health care organizations through the implementation of safe practices at the delivery level. This level is the ultimate target of all recommendations.

The COGME-NACNEP meeting included a series of presentations on various aspects of patient safety during the morning of the first day, followed by structured discussions in smaller groups throughout the afternoon. Each group produced suggested actions that were presented to the full body at a plenary session on the second day. The ensuing discussions produced a consensus around a set of recommendations endorsed by the entire body, organized by the four IOM themes outlined above, since that report provided the impetus for the meeting and joint deliberations.

COGME-NACNEP Recommendations

Throughout the meeting, participants stressed that, if efforts to enhance patient safety are to succeed, there must be close and ongoing collaboration and partnership among physicians, nurses, and all other health care personnel, working together as teams in a systems environment. The meeting participants reached consensus agreement on a set of recommendations, organized by the four IOM

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1 Institute of Medicine, Committee on Qualtiy: *To Err is Human: Building a Safer Health System.* National Academy Press, Washington, DC. 1999. The full text of the IOM report can be purchased from the National Academy Press, or downloaded from the Academy's web site at www.nap.edu/catalog.9728.html.

themes. These recommendations are guided by a set of principles that emerged during the meeting in response to the findings of the joint meeting. Consensus agreement was reached on these principles:

Principle 1. *Patient safety requires the adoption of interdisciplinary practice approaches.*

Principle 2. *Patient safety gains require revolutionary changes in the education and training of physicians and nurses and in their practice approaches to patient care.*

Principle 3. *Current system discontinuities need to be eliminated in building a true, safety-oriented system of care.*

Principle 4. *Patient safety requires significant change in the cultures that guide current medicine and nursing practices.*

Principle 5. *Patient safety requires that patients become acculturated in the need to participate actively in their own health care.*

These principles guided meeting participants in reaching consensus on specific recommendations that are designed to produce the type of major, systemic change needed to achieve levels of patient safety possible given the current state of the art in health care. The recommendations are organized by the themes established in the IOM report to the nation..

IOM Theme 1: Establishing a national focus to create leadership through research, tools, and protocols to enhance the knowledge base about safety

National leadership is needed to provide the resources that will be required to sustain a major systems development that affects the entire health care field. Leadership includes Federal government officials, academic leadership, association leadership, leadership in labor unions, consumer representatives, and all of the major accrediting and licensing/certifying bodies, as well as the leadership in the public and private sector health care practices, insurers and other procurement entities. If the effort to transform the industry is to succeed, a public-private partnership is vital, with all key stakeholders participating in the effort. Specifically, there is need to include business leaders, pharmaceutical industry leaders, and vendors and manufacturers of health-related goods and services. Leadership will provide the resources, but research is vital if the systems are to change intelligently. Because the health care industry acts largely through independent actions by government, academic and health care delivery institutions, many new initiatives are launched over time, but they are not often enough integrated so as to produce the type of knowledge base required for system development.

A. Leadership

The overarching concern of leadership will be to bridge the distinctive cultures of medicine and nursing. Specific recommendations emerging from the meeting regarding the development of leadership on the issue of patient safety include:

1. Convene meetings of deans of professional schools to assure patient safety through interdisciplinary team training. The deans form an especially powerful segment of industry leadership because they command resources, can direct policy changes, and enjoy considerable respect throughout the industry. Without the deans' support, major change of the type being suggested simply will not occur. They are one of the necessary conditions for success.

2. Convene forums of medicine, nursing, and administrative faculties to discuss innovative models and research leading to patient safety.

3. Department of Health and Human Services (DHHS) leadership similarly should convene meetings of agency and bureau leaders who direct the department's substantial health professions training and health care delivery resources to discuss ways in which extant barriers to interdisciplinary team approaches can be eliminated, including the barriers thought to exist through the health care financing systems that support much of health care training and delivery in the country. Changes in the health care financing system would need to encourage team training and practice focused on enhancing patient safety. A revised system needs to account for the value and costs of team training and practice. Financing of graduate education also needs to be adjusted to allow for the initial higher costs of interdisciplinary training sites. Such

intragovernmental meetings may eventually have to be broadened to include the private sector.

4. DHHS and industry leadership will need to act in concert to press for the scope of funding support required to build and sustain system change over time. Overall commitment of funds for enhancement of patient safety should be commensurate with current estimates of injuries and deaths among the general public. Because the rate of injury and death is so relatively high when compared to other industries such as aviation, resources devoted to enhancing patient safety may far exceed the levels currently committed to aviation safety.

5. Analogous to the current model for air travel safety, develop a national organizational structure(s) devoted not only to research, error reporting and compilation, but also to:

- National accreditation authority for patient safety;
- Funding educational simulations, perhaps including the development of a modular simulation lab. The labs could be used for certifying clinicians in patient safety, much as the airline industry certifies its flight staff;
- Continuing education with re-certification covering interdisciplinary team management and performance;
- Contributing to accreditation standards used by other discipline-specific accrediting bodies;
- Support for incentives to promote interdisciplinary education in promoting patient safety;
- Recognition and dissemination of "best practices" in interdisciplinary efforts in patient safety in education and practice.

B. Research and Development

Meeting participants urged the need to sponsor research and development in academic areas and practice management approaches to provide the tools and the knowledge base needed to embark intelligently on system design and implementation. Specific recommendations include:

1. There does not now exist a coherent and accepted core curriculum covering interdisciplinary collaborative team practice approaches.The Health Resources and Services Administration (HRSA) is urged to allocate current funds associated with its various health professions training authorities to the development of such a curriculum. Such a curriculum would focus on patient safety and prevention of patient injuries. A true systems approach would need to be the base for such a curriculum, one that considers and examines the relative risks that exist for patients as they traverse the health care systems, especially through several interfaces.

2. The Veterans Administration (VA) provides a potential model for interdisciplinary team training and practice. The VA has developed successful clinical training initiatives that have brought trainees from multiple disciplines together into an inter-professional clinical practice arena. The VA model of interdisciplinary training could be made available to open practice sites through competitive grant awards.

3. DHHS should support research studies concerning the effects of VA interdisciplinary initiatives on individuals now in practice in other sites. It is hypothesized that clinicians who received training in the VA interdisciplinary model may have been able to influence the practice methods employed by other sites to which they moved. The extent of change they managed to induce would provide insights into the dissemination process required to change practices nationwide.

4. If the existing bodies that accredit health care institutions are to become engaged in the process to transform the industry, they will need new measures that reflect excellence in performance and that relate educational or health care practice approaches to patient safety. Substantial research is needed to establish the relationship between interdisciplinary team practice approaches, true systems operations, and ultimate measures of patient safety. Additional measurement research will be needed to enable accrediting bodies to assess performance.

5. HRSA and other agencies should consider funding Centers of Excellence in Interdisciplinary Team Training and Practice. Such centers could be funded through competitive grant authorities and provide loci for research and innovation that would be disseminated widely. In this connection, it is recommended that HRSA support research into and

dissemination of innovative practice or training approaches that have already been supported either publicly or privately. The Internet can be used as the major dissemination method to publicize successful efforts that already exist, so as to capitalize on the many variations known to exist throughout the country.

6. HRSA and other Federal agencies should support development of private/public partnerships for establishment of interdisciplinary laboratories - "collaboratories" to promote programs in interdisciplinary education and practice focused on enhancement of patient safety. "Collaboratories" could serve as:

- Incubators for the development of learning initiatives;
- Developers of administrative service organizations to support such initiatives;
- Support for use and replication of established models (*e.g.*, the Campbell collaborative model[2]).

7. HRSA should develop/implement a national clinical practice awareness program demonstrating to practice sites the value of interdisciplinary practices for enhancement of patient safety. Use "best practices" research to derive alternative "how-to" models.

8. DHHS should require careful evaluation of all developmental initiatives aimed at innovative interdisciplinary programs or other initiatives seeking to improve patient safety.

9. Investigate the link between fatigue and patient safety and integrate such findings into best practice models of health care training and patient care.

IOM Theme 2: Identifying and learning from errors through immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts with the aim of making sure the system continues to be made safer for patients

Effective and efficient reporting systems that embrace advanced technology and that are integrated with care management are considered a vital and integral part of a transformed system of health care aimed at improved patient safety. Current systems tend to be archaic, given the state of technology available and frequently fail to include the information systems components already known to produce quality information for health care management purposes. Part of the problem in attempting to create an optimal information system in health care is cost. High quality systems are expensive and few health care organizations have been willing to invest the sums required to produce effective systems. But part of the reluctance to embark on new information systems approaches relates to the litigious nature of US society and to the punitive cast attached to current reporting approaches. If enhanced patient safety requires a substantially improved information base, it will be necessary to change the environment in which reporting of adverse events occurs. Conferees recommend the following:

DHHS should encourage the creation of an environment (i.e. academic settings and the public consciousness) conducive to the increased and improved usage of information technology in interdisciplinary education and practice. For example:

1. Initiatives to support faculty development in the area of information technology and its applications as pedagogy. Faculty need both to understand the use of advanced information technology approaches and systems, and how best to teach it.

2. Establishment of standardized patient record models for data encoding and sharing between health care providers and institutions involved in the care of individual patients. The interface problems earlier mentioned are exacerbated by discontinuities on the types of record systems maintained by the different provider groups and institutions. However expensive, we are well past the point at which we can afford to

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[2] Conway-Welch, Colleen, Collaborative Education to Improve Public Safety, in this report.

maintain our current archaic systems of record maintenance.

3. Establishment of strong privacy protections to build public trust. The public is growing increasingly aware that its fundamental privacy rights are violated routinely. The health care establishment cannot afford privacy breaches and we must have security safeguards built in and well publicized to continue to sustain the public's trust.

IOM Theme 3: Raising standards and expectations for improvements in safety through the actions of oversight organizations, group purchasers, and professional groups

The development of a new approach to health care education and management will require the active involvement of the entire industry, including especially those groups and individuals in an oversight or fiscal policy position. New standards, new models, and new reward approaches are required to achieve the level of system transformation intended. To gain the active involvement of the key actors throughout the industry, the meeting participants agreed on the following recommendations:

1. Design a new public-private partnership modeled after the Malcolm Baldrige Awards[3] that exist to reward excellence in private sector enterprise. In this case, the awards would be given to institutions that have demonstrated excellence in patient safety and initiatives to achieve gains in safety. Such a national awards model would elevate the subject to national prominence and create a valuable incentive system for innovations that deliver improved patient safety. The Baldrige Awards program was supported through Federal legislation, but is supported through a public-private foundation.

2. It will be necessary to gain the active support of all the organizations that oversee the performance of health care institutions and, especially those organizations, such as HCFA and the private carriers, that set standards through their financial policies. HRSA should convene policy meetings with COGME and NACNEP leadership to begin a dialogue on how best to gain the support of the key oversight, professional, and financial institutions.

3. Patient safety standards are affected by the wide range of professional licensing standards, which vary among states. Although the Federal government has exhibited understandable reluctance to engage this clear state prerogative, conferees believe that greater uniformity in performance standards leading to professional licensing decisions would eventually lead to greater patient safety. A path to a feasible action plan is not clear to the conferees, although HRSA is urged to initiate discussions with responsible policy officials involved in professional licensing to discuss alternatives to the current variable processes. This issue is potentially so contentious that a major policy-oriented study by the IOM might be required to make progress.

4. Certification and accreditation processes should include specific requirements and criteria for interdisciplinary programs to promote patient safety in practice, professional education, graduate training, and continuing education. Team and collaboration skills, conflict resolution, training in continuous quality improvement, medical error prevention, and ethics should be included in all programs. Programs should be problem-based and require active participation rather than passive learning.

5. Encourage professional organizations and certification bodies to explore the potential for joint MD-Nurse continuing education and training

3 The Malcolm Baldrige National Quality Award was created by Public Law 100-107, signed into law on August 20, 1987. The Award Program, responsive to the purposes of Public Law 100-107, led to the creation of a new public-private partnership. Principal support for the program comes from the Foundation for the Malcolm Baldrige National Quality Award, established in 1988. The Malcolm Baldrige National Quality Award is the centerpiece of the Baldrige National Quality Program. This award, which since 1988 has been presented annually by the President to recognize performance excellence, focuses on an organization's overall performance management system. It does not certify product or service quality.

approach. A joint certifying/accrediting body or reciprocity in accreditation for interdisciplinary programs to promote patient safety might be potential mechanisms.

IOM Theme 4: Creating safety systems inside health care organizations through the implementation of safe practices at the delivery level. This level is the ultimate target of all recommendations

There is a strong belief that practice approaches have their foundation in the education and training system. Accordingly, a wide range of changes is recommended in the approaches being used to educate and train our health care professionals. Specific recommendations regarding academic changes include the following. Many of the recommendations could be pursued by DHHS through the existing Titles VII and VIII authorities:

1. Promote use of simulations in teaching and evaluation of team performance analogous to practices in the aviation industry. This should be ongoing, beginning early in professional schooling, continuing throughout training, and at intervals during professional practice as part of the continuing education and recertification process. Collaborative team approaches should be stressed in both education and evaluation.

2. Teaching should have a problem-based focus, emphasizing interdisciplinary collaboration in systems to enhance patient safety.

3. Link performance evaluation and content of examinations to interdisciplinary collaboration to promote patient safety.

4. Professional education and training in clinical settings should require the incorporation of interdisciplinary delivery of care focused on development and implementation of systems to enhance patient safety. Some percentage of interdisciplinary training, simulations, and/or exercises should be mandatory. Initial programs should emphasize interdisciplinary issues (*e.g.*, teamwork, conflict resolution, practical use of informatics to promote collaboration in enhancing patient safety).

5. DHHS should convene a major inter-bureau/interagency exploratory process to examine areas in which interdisciplinary training or practice might be useful and form a basis for a demonstration. In particular, HRSA should identify programs in which team practice approaches would be suitable and might provide a basis for demonstrations or for adoption of explicit program guidance or criteria in procurement materials.

6. Create a laboratory, either brand new, or within existing settings to develop new types of practitioners and potentially new models of health practice certification or licensing focused on interdisciplinary collaboration to promote patient safety.

7. There is a critical need to address the lack of faculty qualified to teach interdisciplinary practice. This should be done by a combination of public and private mechanisms:

A. Creation of a fellowship program to develop faculty leaders in interdisciplinary education to promote patient safety.

B. Develop specialty initiatives for doctoral education in interdisciplinary education to promote patient safety.

C. Create new models for doctoral and other graduate interdisciplinary education.

D. Create research funding for a new model of academic education that focuses on interdisciplinary practice to promote patient safety.

E. DHHS should:

(1) Work with academic and training institutions, national professional organizations, foundations and other interested entities to create incentives for faculty engaged in interdisciplinary work on patient safety.

(2) Work with public and private academic and professional organizations to encourage institutions to reward teaching in interdisciplinary programs on patient safety through the tenure system.

(3) Adopt a new incentive program to reward faculty for development of innovative teaching practices through fellowships and scholarships.

(4) Encourage appointment of faculty focused on interdisciplinary practice.

(5) Work with public and private academic and professional organizations to encourage institutions to synchronize academic calendars in professional schools to facilitate the development and expansion of interprofessional programs to enhance patient safety.

(6) Examine the distribution of funding for graduate health professions education (*i.e.*, Medicare/GME payments) to encourage greater support for community-based interdisciplinary education.

(7) Establish programs to identify and eliminate barriers that prevent faculty from participating in interprofessional practice and education programs, and serve as a faculty resource on interdisciplinary training and practice:

- Develop a repository for "best practices" for faculty in interdisciplinary programs to enhance patient safety;
- Provide incentives for development of faculty practices designed for interdisciplinary education and research to promote patient safety;
- Work with professional organizations and public agencies to encourage removal of barriers to faculty teaching in interdisciplinary programs (*i.e.*, certification requirements, practice acts, regulations).

COLLABORATIVE EDUCATION TO ENSURE PATIENT SAFETY: A REPORT ON A JOINT COGME-NACNEP MEETING ON THE IMPLICATIONS OF THE IOM REPORT

Summary of Collaborative Activities

This report describes the results of a joint meeting between national advisory councils in Medicine and Nursing to enhance patient safety. The meeting was held to discuss ways in which health care professionals might collaborate to respond usefully to the findings in the Institute of Medicine's report, "To Err is Human: Building a Safer Health System."

The meeting was carried out by the Council on Graduate Medical Education (COGME) and the National Advisory Council on Nurse Education and Practice (NACNEP). Both COGME and NACNEP are chartered advisory councils to the Congress and the Secretary of Health and Human Services. Under the requirements included in the Health Professions Education Partnerships Act of 1998 (Public Law 105-392), the latest authorization of these two advisory councils, they are both mandated to assess the workforce trends in their respective professional bodies and recommend actions to address identified needs.

In recognition of the need for interdisciplinary approaches that would augment the discipline-specific activities, COGME and NACNEP initiated their first joint activity in 1994. This first collaborative effort focused on the interdisciplinary primary care workforce, developed an analytic approach to estimating requirements for primary care providers, and recommended further work toward eliminating barriers and facilitating collaboration. The results were published in December 1995 in the Report on Primary Care Workforce Projections. Through this current focus on the need to work together to enhance patient safety, the two Councils have furthered their work toward facilitating collaboration.

Introduction

Denise Geolot, Ph.D., R.N., Chair of NACNEP and Director of the Division of Nursing in the Bureau of Health Professions opened the meeting. Dr. Geolot noted that the Federal government has launched a series of actions, spurred on by the Institute of Medicine report on the effect of medical errors on patients. The Quality Interagency Coordination Task Force (QuIC) provides an action plan for the Federal government in its report to the President, "Doing What Counts for Patient Safety." Its 101 recommendations cover a wide range of activities designed to further the elimination of medical errors and enhance patient safety. The recommendations are intended to guide activities by the Federal agencies whose mission provides primary responsibility for the activities. The recommendations involve augmenting procedures and actions already underway by federal agencies; providing leadership and working cooperatively with public and private sector entities; developing data systems, research, and strategies to improve procedures throughout the health care system; and developing approaches to increase public awareness and information.

Basic to the success of this undertaking is the need for physicians and nurses with prime responsibility for managing and delivering health care to work together in enhancing and carrying out the strategies. The meeting of the two councils is intended to add to this action agenda through the recommendations of the meeting participants regarding public and private sector initiatives that could be undertaken to

demonstrate the efficacy of collaborative activities toward the goal of assuring patient safety.

C. Earl Fox, M.D., HRSA Administrator, outlined the actions being taken by DHHS to promote greater safety through collaborative working arrangements. Dr. Fox noted the importance of the meeting, in view of the IOM report's sense of urgency.

Dr. Fox reported to the participants on the specific actions initiated recently by HRSA. Earlier this year, HRSA concluded reorganization within the Bureau of Health Professions, creating a new division of interdisciplinary and community-based programs. This is the first new division created in the Bureau in some years. All of the Bureau's interdisciplinary training programs are now located in the new division, including the Area Health Education Center (AHEC) and Health Education Training Center (HETC) programs, the Geriatric Education Centers (GEC) and a number of others.

Through this new division, HRSA accomplishes three things:

- The division reflects a stepped-up commitment within the Agency and within the Bureau to interdisciplinary training and to quality improvement.
- The division provides a single office to which the health care community can look for guidance in these issues.
- The division provides other developmental agencies and those organizations in and outside the department a clear idea of how important collaborative education is to HRSA.

Beyond this reorganization, HRSA, through the Bureau of Health Professions, has funded the Interdisciplinary Generalist Curriculum (IGC) project; a demonstration aimed at examining how pre-clinical curricula affects medical students' career choices. The Bureau has also funded the Undergraduate Medical Education for the 21st Century (UME 21) project, which retains an interdisciplinary focus in looking at how to make medical education in the 21st century more relevant to the real-life challenges faced by health care practitioners.

Dr. Fox stressed that the public wants solutions. With estimates as high as 98,000 people dying annually from preventable medical errors – analogous to a jumbo jet crashing every day—we must act to improve the inherent safety of our medical system. Toward that end, the Bureau is convening a meeting on the 11th and 12th of December to discuss the work that has been done on defining U.S. health care workforce requirements. The department will be releasing at that meeting, for the first time ever, state workforce profiles. These state-specific profiles will cover physicians, nurses, dentists, and other health care practitioners. The profiles will include numbers of providers, provider/population ratios and other types of demographic indicators. The information being produced also will address the public health workforce, which presents its own organizational complexities.

Dr. Fox finally noted his hopes and expectations that the meeting participants would produce recommendations covering all aspects of the health care education and practice systems.

Sam Shekar, M.D., HRSA Associate Administrator for Health Professions and Director of the Bureau, stressed one of the central themes of the IOM report and the meeting—that the system needs changing, but that will not happen by focusing on errors by individual practitioners. The IOM report used the phrase "silos of excellence" in referring to the separations and divisions between nurses and physicians. In practice, these "silos" acted as chasms separating physicians and nurses and creating opportunities for miscommunication.

Dr. Shekar challenged the meeting participants to help the various communities involved in health care to find ways to work together, to improve education and, ultimately, patient safety. Just as physicians and nurses work best for the patient when working together, this meeting was intended to bring about collaborations to improve health education policy, and teach cooperation, partnership, and teamwork from the very beginning of the educational process.

The two co-chairs, David Sundwall, M.D., chair of COGME and Susan Johnson Warner, Ed.D., R.N., co-chair of NACNEP addressed the meeting briefly on their experiences as practicing physician and nurse

respectively. Both provided examples of the positive effects of collaborative working relationships on their ultimate care quality in terms of protecting their patients. "Think to the future, and be bold" was their advice to the conferees.

The Issues as Outlined by Speakers at the Meeting

Prior to the Councils deliberations, they were addressed by seven invited national leaders who were charged with addressing current barriers to collaborative education and practice. They were asked to provide specific recommendations for educational strategies to promote collaborative approaches that ensure patient safety, and to tie these recommendations to those outlined in the IOM Report. These speakers submitted manuscripts that elaborated on their remarks. Their complete manuscripts follow this section of this report

The issues presented by meeting speakers during the initial session are organized by the four central themes of the IOM report:

IOM Theme 1: Establishing a national focus to create leadership through research, tools, and protocols to enhance the knowledge base about safety

The need for national leadership was stressed throughout the presentations and in all of the workshop discussions. Much as the issue of child abuse was finally brought to the attention of the public because of the growing availability of medical evidence, the IOM report, which provides an evidence base, can provide the impetus for national action. But worries exist that patient safety improvements require sustained, long-term investments in new and improved systems, educational modifications, and a cultural shift away from the narrow confines of educational and discipline-based "silos" which now dominate health care. The leadership within the professions and the industry must be convinced to adopt new methods and to place patient safety as a dominant performance criterion for successful systems.

Furthermore, speakers stressed that patient safety is not an issue susceptible to single improvement initiatives. Improvement over time will come about only through adoption of a permanent focus on safety and reduction of errors and through pursuit of true systems in which errors are difficult to make. Aviation was highlighted as an example of an industry that had moved well ahead of health care in this regard. Collaborative teams dominate aviation, and the field is replete with examples of systems that have been designed explicitly to reduce the probability of error. Health care, in contrast, has been developed over decades as a field of skilled artisans, in which individual excellence is valued often at the expense of system performance. In collaborative environments created to devise and implement improved health care approaches, the most successful interventions were those changes to systems or procedures that created processes in which errors were more difficult to make. The least successful interventions were those that focused on teaching people the right things to do.

Speakers noted that:

- Errors are a useful starting point for improving quality. Errors represent a clear and understandable issue to both the professionals and the public. Errors and the resulting safety threats can be used to build a national consensus in favor of systemic reform efforts.
- Systems designed for safety often function more efficiently if implemented through interdisciplinary team approaches. Although interdisciplinary practice approaches can be learned, they should be introduced early during the education and training of health care practitioners.
- Collaborative and interdisciplinary learning environments expose learners to experts they would otherwise never meet, providing perspectives that bring fresh insights to common problems confronted in today's increasingly complex care settings.
- A major deficit exists in the current system capacity for effective teachers and coaches to young professionals. Many current faculty are unprepared in interdisciplinary "improvement processes." Real system improvement will require our faculty to receive training and to develop skills now largely missing; thus an

early focus on faculty development initiatives will be needed.

IOM Theme 2: Identifying and learning from errors through immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts both with the aim of making sure the system continues to be made safer for patients

Speakers stressed the need for real systems to supersede the current pseudo-systems that characterize health care. But real systems require intelligent information that can be used for continued systems improvement. At a very basic level, it will be necessary to confront the fact that the current health care "system" functions as a "system" in name only. Mainly, health care operates through relatively isolated professional/managerial silos, with inadequate information flowing between them. Systems fragmentation affects information flows throughout the system and especially feedback to health care professionals about patient outcomes. Relatively few existing health care entities have adopted information systems that capitalize on available data in intelligent ways.

System improvements need to focus initially on those parts of the systems of care that introduce the greatest potential for error. The single most common injury-inducing event is adverse drug events, defined as overdoses, allergic or idiosyncratic reactions, drug-drug interactions, or errors in the route, rate, timing or patient. Estimates suggest that approximately two percent of patients are affected and that the average cost of such (moderate or severe) events approximates $2,400.

Current reporting systems within most hospitals miss most adverse drug events by a substantial amount. In tests conducted within the LDS Hospital in Salt Lake City, it was discovered that conventional nurse incident reports surfaced approximately six such adverse drug events per year; an enhanced reporting system discovered ten times as many events. But an electronic medical record system uncovered 80 times as many events, two orders of magnitude greater than the normal voluntary system.

Reporting systems for addressing safety issues will need to include common injury reporting, coupled with some form of clinical response system with health care professionals feedback, and a rare event tracking system.

A potentially large barrier to truly effective reporting systems is the current punitive atmosphere that characterizes many health care institutions. To achieve any progress, event reporting is required and event-reporting systems can only function within the context of a non-punitive environment. It is important that benign errors make their way into reporting systems, as well as those errors that produce active harm. Reporting systems should be of the "high detection sensitivity" type, because such systems produce more information for analysis of systemic improvement potential. Such systems require great clarity about the threshold of culpability, i.e., when will people be held accountable for their errors through punitive discipline of some type? Generally, that line should be drawn at reckless behavior. The focus should remain on providing feedback to the health care professionals so as to make evident the benefits of alterations to practice methods.

IOM Theme 3: Raising standards and expectations for improvements in safety through the actions of oversight organizations, group purchasers, and professional groups

The health care industry is dominated by professional associations; accrediting, licensing and certifying bodies; and a vast array of insurers and group purchasers, all of whom are able to exert considerable influence over the standards of care. Many of the professional groups that dominate much of the current dialogue on health care approaches are themselves bound by cultures that are powerful and not easily changed. System development and reform efforts may require a cultural sea change, in which the leadership must combine with a consensus of the membership of these organizations to force through the difficult and contentious changes required to achieve successful system improvements. However much we might wish it otherwise, it likely is the case that consumers are unlikely to drive the changes needed throughout the industry. In the views of some of the speakers, consumers, although affected by the

health care system's foibles, are unlikely to drive the changes required in professional educational systems. Accrediting and certifying bodies must begin to insist on collaborative learning processes and systems approaches to quality improvement if change is to occur at all.

IOM Theme 4: Creating safety systems inside health care organizations through the implementation of safe practices at the delivery level. This level is the ultimate target of all recommendations

Research evidence suggests strongly that interdisciplinary teams function most effectively, promoting overall effectiveness and patient safety simultaneously. Such team functions extend well beyond health care to other fields in which safety is of equal concern. Many other fields –aviation was cited often— have progressed well beyond health care to address safety concerns and to adopt interdisciplinary team approaches.

Several speakers noted the role of computers in achieving system improvements.

- The complexity of modern health care exceeds the capacity of the unaided human mind. Computers are needed to assist with collection and synthesis of the data needed to produce intelligent assessments of probable outcomes in therapeutic processes.
- Health professionals need to become acculturated to the process of entering patient notes in formats usable in the context of computer systems.
- Clinical guidelines and evidence-based practice are not optimized currently for computer-based systems. Contributing to the problem of moving the field forward is the absence currently of true collaborative interdisciplinary work environments with continuing attention to research and evidence-based practice. Standards continue to be derived in discipline-specific and practice-specialty silos.

Work Group Deliberations and Suggestions to the Plenary Body

Following the plenary session, three discussion groups were formed to consider how best to proceed in the face of the material presented to the group earlier in the day. In their charge, each discussion group was asked to address a set of issues or problems related to patient safety. Although the main focus of the meeting was education and training, participants were asked to consider and raise any concepts or approaches that might lead to a safer health care system. Thus, legislation, regulations, and new investments were considered to be "on the table."

The three discussion groups were asked to consider the following issues:

- Collaborative education and training
- Collaboration in practice and continuing education
- Preparing faculty to work and teach in collaborative systems environments

The central goal for each group was the same—provide suggestions to the main meeting plenary session concerning how to improve patient safety. Suggestions emerging from the three work groups are synthesized below, organized by the same four IOM themes used above.

IOM Theme 1: Establishing a national focus to create leadership, research, tools and protocols to enhance the knowledge base about safety

1. Create a National Safety Advisory Panel

All of the groups produced a suggestion concerning the establishment of a national agency to monitor safety in health care. The agency would be charged with patient safety as its primary mission and promoting collaborative education models as one of its main strategies. They suggested modeling the agency after some of the aviation industry institutions, although questions exist concerning the power and authority to be invested in such a group; that is, should it be primarily advisory or should it have teeth to be able to order changes? Second order

questions arise concerning the role of such an agency in view of other Federal or national agencies that might exist. It is possible that a central patient safety agency could serve as a source of research and demonstrations, and as a primary advisor to Congress and the Executive Branch. It is envisioned that both public and private funding would be used to support the agency.

The agency's role could include:

- National accreditation authority for patient safety
- Funding educational simulations, perhaps including the development of a modular simulation lab. The labs could be used for certifying clinicians in patient safety, much as the airline industry certifies its flight staff;
- Continuing education with re-certification covering interdisciplinary team management and performance;
- Contributing to accreditation standards used by other discipline-specific accrediting bodies.

2. Research and Demonstrations

Research is needed to demonstrate the value of interdisciplinary team training, in continuing education on patient safety. Once practitioners are shown a sound body of evidence illustrating the value to patients they will flock to the courses. Continuing education may be required to maintain licenses, but if real value in terms that benefit patients can be demonstrated, much potential resistance would be overcome.

It was suggested that private/public partnerships are needed for establishment of interdisciplinary laboratories -"collaboratories." These laboratories would be incubators for the development of new learning initiatives. In addition to development of these new approaches to learning, the labs would sponsor thoughtful evaluations of the effects of these initiatives on the ultimate goal of patient safety. It might be useful to consider use of new administrative service organizations to support such learning laboratories around the country.

The Campbell Collaborative model[1] is viewed as an exemplar of such an approach. Other areas of potential R&D programs to be considered for Federal funding support include:

- Centers for Excellence in interdisciplinary training and practice.
- Expansion of the VA's model of interdisciplinary training. The VA has developed successful clinical training initiatives that have brought trainees from multiple disciplines together into an inter-professional clinical practice arena. The VA model of interdisciplinary training could be made available to open practice sites through competitive grant awards.
- Studies concerning the effects of VA interdisciplinary initiatives on individuals now in practice in other sites.
- Develop and implement a national clinical practice awareness program demonstrating to practice sites the value of interdisciplinary practices in terms of patient safety. Use "best practices" research to derive alternative "how-to" models. Best-practices would always need to focus on patient safety as the ultimate intended outcome. Research is also needed to develop better measures of practice excellence and patient safety outcomes in order to identify and publicize the better practice sites.

3. Legislative and Policy Initiatives

Achievement of true interdisciplinary team models throughout the health care system is not an easy feat

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[1] The Campbell Collaboration is an emerging international effort that aims to help people make well-informed decisions by preparing, maintaining, and promoting access to systematic reviews of studies on the effects of social and educational policies and practices. The approach is described in the manuscript written by Colleen Conway-Welch, which can be found in this report.

to contemplate, as a number of statutory, cultural, and financial obstacles exist. However potentially attractive, novel interdisciplinary team models challenge existing norms and statutory definitions of practice. Incentives need to be created to convince practitioners to consider shifting to interdisciplinary practices. The financing system currently inhibits such practices. Further, the high cost of interdisciplinary training is a formidable barrier to widespread adoption of such an approach. The current financing systems should be examined by DHHS to remove existing disincentives to interdisciplinary practices that may exist to affect education and training, as well as practice sites.

Numerous regulatory and statutory impediments exist to training and implementation of interdisciplinary team models. For example, practice definitions for medicine, nursing, and the other health disciplines differ from state to state and impede closer collaboration between the disciplines. To that end, a suggestion was offered at the meeting to investigate the possibilities of more integrated health discipline practice regulations through design and implementation of a national practice act. One example provided is the Canadian licensing authority, which regulates medicine and nursing together. Anything that can enable breaking down the existing silos of education and practice ought to be explored. A new legislative authority is also considered to be necessary to support a variety of innovative joint education and training initiatives aimed specifically at improvement of patient safety. Such initiatives could include interdisciplinary training and practice, joint faculty development, and curriculum development – all within the context of a multicultural workforce and population.

4. Qualified Faculty

Leadership requires qualified faculty. To the extent that current faculty lack appropriate skills and training in interdisciplinary group practices, new methods will not spread to the extent required for major systems change. HRSA needs to address the lack of faculty qualified to teach interdisciplinary practice, by a combination of public and private mechanisms. Suggested approaches include use of the existing Title VII and Title VIII faculty development program authorities to promote participation of faculty through:

- Faculty traineeship, fellowships and scholarships;
- Creation of a new fellowship program to develop faculty leaders in interdisciplinary education;
- Development of specialty initiatives for doctoral education;
- Creation of new models for doctoral education that provide incentive for faculty to pursue interdisciplinary "specialties."

Faculty is also rewarded at present for pursuing particular aspects of their work that are valued highly by the institution, such as research. Tenure is awarded, perhaps disproportionately, based on research as distinct from teaching. HRSA could also work usefully with national professional organizations, foundations and other interested entities to create incentives for faculty engaged in interdisciplinary work. Ideas suggested for consideration include:

- Explicit rewards for teaching interdisciplinary subjects through the tenure system;
- Federal support for research grants for evaluation of innovative teaching strategies;
- Synchronization of calendars to promote transprofessional discourse;
- Federal awards to faculty for development of innovative teaching practices through fellowships and scholarships;
- Encourage appointment of faculty focused on interdisciplinary practice, perhaps through use of funding criteria in grant programs;
- Re-examine the distribution of funding for graduate health professions education, i.e. Medicare/GME payment in light of the need for interdisciplinary, community based education.

HRSA needs to identify and eliminate barriers that prevent faculty from engaging in interdisciplinary practice and thus serving as a faculty resource on interdisciplinary training and practice. In a number of cases, one type of faculty is prevented from teaching in a different setting, by state requirements, as for example, a physician teaching nurses in a school of nursing. If we are to implement a true interdisciplinary team approach, such barriers need to be eliminated. HRSA could focus on:

- Development of a repository for best practices in innovative interdisciplinary models;

- Providing incentives for development of faculty practices designed for interdisciplinary education and research;
- Removal of barriers to faculty teaching in interdisciplinary programs, i.e. practice acts, regulations.

5. Interdisciplinary Curricula

Along with well-trained faculty, there is need to begin work on development of an interdisciplinary core curriculum for all people with patient contact related to prevention of patient injuries and errors. Such a curriculum would focus on patient safety and prevention of patient injuries, emphasizing a systems-based approach to performance improvement. Various models exist, such as HRSA's Interdisciplinary Generalist Curriculum (IGC) project and even the later Undergraduate Medical Education for the 21st Century (UME-21) demonstration. A true systems approach would need to be the base for such a curriculum, one that considers and examines the relative risks that exist for patients as they traverse the health care systems, especially through several interfaces. This suggestion could be implemented through HRSA's current Title VII and VIII authorities.

IOM Theme 2: Identifying and learning from errors through the immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts both with the aim of making sure the system continues to be made safer for patients

Reporting Systems: Incentives and Disincentives for Safety

A. The current health care and legal systems in the country promote a protective health care community environment. Errors that are caught are often buried, removing them from the body of information that might be used for system improvement purposes. While it is certainly the case that errors resulting in actual patient harm are examined generally for corrective actions, the focus of such investigations is still on penalties. Available data on errors and patient injuries support strongly the concept of reporting as many errors as can be discovered in a true search for improvement. In place of penalties, rewards of some type should be developed and applied for discovering errors.

B. HRSA should encourage the creation of an environment (i.e. academic settings and the public consciousness) conducive to the increased and improved usage of information technology in interdisciplinary education and practice. For example:

- Initiatives to support faculty development in the area of information technology and its applications as pedagogy. Faculty need both to understand the use of advanced information technology approaches and systems, and how best to teach it.
- Establishment of standardized patient record models for data encoding and sharing between health care providers and institutions involved in the care of individual patients. The interface problems earlier mentioned are exacerbated by discontinuities in the types of record systems maintained by the different provider groups and institutions. However expensive, we are well past the point at which we can afford to maintain our current archaic systems of record maintenance.
- Establishment of strong privacy protections to build public trust. The public is growing increasingly aware that its fundamental privacy rights are violated routinely. The health care establishment cannot afford privacy breaches and we must have security safeguards built in and well publicized to continue to sustain the public's trust.

C. Beyond errors per se, an award system similar to the Baldrige award[2] program should be instituted to focus on examples of excellence in interdisciplinary team management leading to safer health care institutions. The awards should always recognize that patient safety is the ultimate measure of success.

IOM Theme 3: Raising standards and expectations for improvements in safety through the actions of oversight organizations, group purchasers, and professional groups

1. Federal Government Initiatives

Although several HRSA initiatives in interdisciplinary approaches were mentioned early in the meeting, HRSA and the other major Federal funding agents

need to become models of excellence themselves. The group suggested that HRSA convene a major interbureau/interagency planning process to determine how best to shift its strategic workforce development authorities so as to capitalize on this recent priority. Demonstrations aimed at using existing authorities in new and more productive ways in terms of interdisciplinary training and workforce development is only one avenue to explore.

Although no specific suggestions emerged, the government should consider the potential for improving systems through patient involvement. Patients who are knowledgeable and active participants will produce an inherently safer system. Although few such vehicles exist currently, it may be worthwhile to consider development of new approaches to consumer awareness—e.g., giving patients questions to ask when they become patients as a supplement to their "bill of rights." Perhaps, consumer awareness programs could be initiated as public programs, through the Internet, or even in general course material in other non-health educational settings.

Other Federal initiatives that should be explored include:

- Develop joint physician-nurse continuing education programs that are certified by the respective nurse and specialty boards. This recommendation could be broadened to include other disciplines in a true interdisciplinary continuing education model.
- The Federal government could create a new funding stream to support research into new models of academic education approaches that foster interdisciplinary team practices.
- Create a laboratory, either brand new, or within existing settings to develop new types of practitioners and potentially new models of health practice licensing, including a national licensing approach. This last recommendation runs into the thicket of barriers that exist through state and discipline specific licensing laws. Perhaps now is the time to consider the value of a national licensing system.
- Develop a national leadership program for interdisciplinary practice. This might begin by convening the deans of schools to discuss and reach consensus on the value and importance of interdisciplinary team training and practice.

2. Accreditation

In attempting to foster change in a change-resistant educational system, accreditation bodies play a major role. If accreditation bodies decide that particular skills are required to become accredited, change is more likely to occur. Accreditation standards could be developed for interdisciplinary aspects of:

- Collaborative efforts/skills
- Information technology
- Continuing education
- Medical errors/prevention
- Mechanisms for continuous quality improvement.

IOM Theme 4: Creating safety systems inside health care organizations through the implementation of safe practices at the delivery level. This level is the ultimate target of all recommendations

Educational Initiatives

One group discussed the most effective way to instill team concepts throughout the system, and suggested that the educational system is the most appropriate starting point. Clearly, team concepts must be modeled and transferred into the practice setting, but

[2] The Malcolm Baldrige National Quality Award was created by Public Law 100-107, signed into law on August 20, 1987. The Award Program, responsive to the purposes of Public Law 100-107, led to the creation of a new public-private partnership. Principal support for the program comes from the Foundation for the Malcolm Baldrige National Quality Award, established in 1988. The Malcolm Baldrige National Quality Award is the centerpiece of the Baldrige National Quality Program. This award, which since 1988 has been presented annually by the President to recognize performance excellence, focuses on an organization's overall performance management system. It does not certify product or service quality.

it must have a strong academic/theoretic support structure to be successful.

Interdisciplinary training rotations must be a mandatory part of physician and nurse education and must incorporate all the key professions. Elective rotations simply do not work as well or as efficiently as required rotations. By requiring such rotation, students and practitioners alike are alerted to the high priority accorded the subject. Other educational recommendations include:

- Training in clinical settings must incorporate trainees into interdisciplinary teams that are assigned tasks/problems to resolve as teams and be evaluated as teams.
- Link team training to performance evaluation, exams, and accreditation to collaboration and collaborative education in patient safety. If these accreditation standards are then linked further to the financing system, health care entities will begin to implement quickly.
- Explore potential for joint MD-Nurse CE training approach. Joint CE certifying/accrediting body might be required. Reciprocity in accreditation might be one approach.
- Simulations using a case-based approach should be designed for medical schools and nursing schools as a major teaching approach that would involve teams managing real-life patient cases. The team would be graded, rather than the individuals. Simulations could be used both as a primary educational approach and as a certifying model. Simulations could build in ethics issues and would rely on technology, much as is done in aviation, to the maximum extent practicable.
- Problem-based education involves collaborative educational approaches, in which students operating in teams are presented with problems that must solve using team approaches. Several schools across the country have adopted similar models, so we are not without precedent. Demonstrations need to be started in both large and small institutions and academic health science centers, and it is important to look for institutions that can generate second-order change effects.

The work group sessions allowed meeting participants to brainstorm new ideas for transforming an industry that appears to be highly resistant to change in certain areas, while encouraging new approaches to disease prevention and therapies in many other areas. The plenary session was used by meeting leadership to allow participants to exchange these ideas and to reach consensus on which recommendations to pursue. Indeed one of the strong recommendations emerging from the meeting was to continue the type of collaborative discussions exemplified by the meeting itself

Public Comments

Bill Robinson, M.D., Chief Medical Officer for HRSA and head of its Center for Quality, delivered some comments on the meeting. His brief discussion focused on the recommendations made at the joint meeting in the context of governmental efforts in quality improvement, and included the following points:

- Dr. Fox, the HRSA Administrator sits on QuIC – Quality Interagency Coordination Task Force –QuIC is an interdepartmental activity that includes DHHS, VA, Department of Labor (DOL) and all other government agencies. HCFA and the Agency for Healthcare Research and Quality (AHRQ) are represented within the DHHS contingent on QuIC. HRSA chairs a workforce working group on QuIC.
- Within HCFA, there is a new group--the Center for Quality Improvement and Patient Safety-- that is now engaged in work on this broad patient safety agenda.
- Dr. Fox also sits on the Secretary's Quality Council, which will be brought into this policy discussion and informed of all recommendations emerging from this meeting.
- We need to move this quality agenda forward as rapidly as possible, to avoid losing any momentum.
- HRSA has a quality work group that includes representation from all of HRSA's bureaus. That group will be used to press for even greater collaborative efforts on this issue than we have in the past.

Putting Patients First:
Improving Patient Safety through Collaborative Education

August 2000

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In the past, she has been a Legislative Assistant and Chief of Staff for United States Senators Kent Conrad (D-ND) and Quentin Burdick (D-ND), has advised on a broad range of health policy issues, drafted legislation, and worked with interest groups and legislative offices. She has also consulted for the World Health Organization Global Programme on AIDS, served on many private sector health-related advisory boards, was a member of President Clinton's Advisory Committee on Quality of Health Care in America and the Advisory Commission to the DHHS Office of Rural Health Policy, and advises Congress as a member of the Medicare Payment Advisory Commission.

Dr Wakefield also currently serves on the Institute of Medicine's Committee on Quality of Health Care in America, which released the recent report on medical errors. She has presented on public policy, the political process, and strategies to influence it at national and international forums, authored numerous articles on health policy, and served on editorial boards of several professional journals. Her leadership in nursing and health has been acknowledged in awards from multiple organizations, including the American Organization of Nurse Executives, American Nurses Association, National League for Nursing, American College of Nurse Practitioners, and National Rural Health President's Award. She is a Fellow of the American Academy of Nursing.

Putting Patients First:
Improving Patient Safety through Collaborative Education

Mary K. Wakefield Ph.D., R.N.

Eileen T. O'Grady Ph.D., N.P.

... First of all, PARC was fundamentally noncollaborative when I first came—there was surprisingly little cross-disciplinary work. There were turf wars and physicists, for example, weren't allowed to talk with computer scientists.... To me the white space between fields is... the place to explore.... If you get multiple disciplines together working, around the root of a problem, it pulls you out of your own discipline and fuses different points of view that lead to a reframing.

-John S. Brown, former Director, Xerox Palo Alto Research Center (PARC), a leader in technology development commenting on the importance of multidisciplinary effort.

Introduction

Ensuring quality of health care has been a long-standing interest of health care stakeholders. For example, state and federal governments use an array of regulatory mechanisms to monitor and assure at least minimum quality for American consumers receiving care in a wide variety of health care settings; mechanisms that are designed to address care quality rendered by both individual providers as well as institutions. Health care professionals are taught, beginning with their first clinical courses, the importance of patient safety and approaches to achieve appropriate care outcomes. Consumers from around the world, with the means to access it, frequently seek U.S. health care because of its recognized quality mantra. The quality of health care rendered in the United States is, in many instances, unparalleled in the world. Recently however, increased attention has been focused on care where quality is compromised and patient safety is threatened.

Historically, injuries in health care have not been perceived as a major problem in American health care systems because, according to Leape (1994), adverse events are scattered, most errors do not lead to serious injury, and the culture of health care leads clinicians to deny or conceal errors. Nevertheless, clinicians know, research findings indicate and recent policy documents describe quality of care that, far too frequently, is not as good or safe as it could or should be. This paper describes recent policy statements and recommendations on how patient safety can be improved, focusing specifically on nurse-physician collaboration and will expand upon implications for collaboration included in the Institute of Medicine's (IOM) report "To Err is Human" and, to a lesser extent, other publications.

Collaboration, taught and modeled in educational environments and practiced in health care settings, is essential to improvements in patient safety. The IOM report bluntly states, "Most care delivered today is done by teams of people, yet training often remains focused on individual responsibilities leaving practitioners inadequately prepared to enter complex settings. ....the "silos" created through training and organization of care impede safety improvements (Kohn et al., 2000, p. 146).

Patient Safety in the Context of Quality Health Care

Quality of care and more specifically patient safety has been the focus of articles, research studies and important public policy reports over the past few years. The Institute of Medicine defines quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health care outcomes and are consistent with current professional knowledge" (Lohr, 1990). Safety, a domain of quality, is defined as freedom from accidental injury and it "does not reside in a person, device or department, but emerges from the interactions of components of a system" (Kohn et al., 2000, p. 57). System components include the

individuals interacting within health care systems to safely deliver care.

In 1998, health care quality was put directly and visibly on the national public policy agenda. The President's Advisory Commission on Consumer Protection and Quality in the Health Care Industry, a temporary commission established by President Clinton, produced a report that addressed ensuring and promoting protection of consumers and health care quality. Concerns around safety and medical errors featured prominently in this report titled "Quality First: Better Health Care for all Americans". Serious gaps in quality were cited and the report called for making health care quality a national priority. Six aims were clearly identified and prioritized as starting points for improvement. Importantly, one of the proposed aims for improvement was to reduce health care errors. Included in the range of recommendations to improve quality, reduce errors and improve safety in health care were explicit references to the need to engage health care professionals in interdisciplinary activity. Health professions training programs were exhorted to alter the education and training of physicians, nurses and other health care workers by increasing student experience in working in interdisciplinary teams. Speaking specifically to medical education the report stated that "Physicians increasingly are being asked to work in interdisciplinary teams...and to participate in quality improvement efforts. Medical colleges, teaching hospitals, and other institutions that provide medical education must ensure that the physicians they train develop competence in these areas" (Quality First, 1998, p. 200). An interdisciplinary approach to conducting research and demonstration initiatives addressing quality improvement was also recommended. In addition to commenting on academic content and research approaches important to quality, the commission also highlighted the need for clinicians in health care settings to possess a broader systems perspective. Specifically, the commission stated that "...in health care organizations, much of (the) learning is aimed at improving individuals—physicians learning to become better physicians, nurses learning to become better nurses—rather than learning how the system as a whole can improve" (Quality First, 1998, p. 186). An interdisciplinary, collaborative orientation would be essential to accomplishing this. Clearly, isolated, discipline-specific efforts to improve quality and patient safety were viewed as wholly inadequate.

A few months after the release of the Commission's report to the President, the Institute of Medicine (IOM) established the Committee on Health Care Quality in America. The committee was charged with developing a strategy that would result in a threshold improvement in quality over the subsequent ten years. The first report of the IOM Committee, "To Err is Human", focused specifically on patient safety. Reviewing well over 30 research studies, the Committee concluded that the magnitude of health care errors is extremely serious, that it is essential to design safety into health care systems at all levels, and that barriers to safety improvement must be broken down.

Improving patient safety is complex in that health care errors transcend all settings where care is delivered and engage all categories of health care workers. Patient safety improvement requires multi-level system changes, including addressing thorny challenges such as eliminating the prevalent culture of singling out individual clinicians and blaming them for errors. Focusing blame on individuals misses system vulnerabilities and strongly discourages clinicians to report errors. Burying information on errors limits ability to analyze them and, most importantly prevent their reoccurrence.

In and outside of health care, safety systems can have both local and organization-wide components. Local systems operate at the level of a small work group, such as a team of health care providers or a cockpit crew. Organization-wide safety systems cut across teams and departments and include processes such as medication administration (Kohn et al., 2000). To date, quality improvement efforts within health care have focused at the individual level, rather than at the local and organizational level. In the delivery of patient care, targeting safety improvement efforts at both levels is relevant.

In spite of both well-documented adverse health consequences resulting from compromises in patient safety and associated financial costs, efforts to ameliorate health care errors have been insufficient. In fact, the IOM committee charges, "Health care is a

decade or more behind other high-risk industries in its attention to ensuring basic safety" (Kohn et al., 2000, p.5). While the IOM report included findings and recommendations for virtually every stakeholder in health care, only those relevant to nurse-physician interaction are discussed here.

The IOM Report.

To Err is Human: Building a Safer Health System Errors in health care that compromise patient safety can be tied to latent failures embedded in the structure and function of systems. While technology and human interface is a key focus for improving safety, efforts to address human interactions are equally important. For example, considerable work in human factor analysis has focused on the recognized need to improve communication and coordination among team members in order to create safe systems. Consequently, educational preparation of providers and expectations for their interactions in health care systems should be designed so that ineffective and potentially problematic interactions are minimized or eliminated and collaborative, team oriented efforts are encouraged. A number of the recommendations included in the IOM report directly or indirectly contribute to achieving this outcome and are referenced here.

IOM Recommendation: *Congress should create a Center for Patient Safety in the Agency for Healthcare Research and Quality.*

The Committee recommended and the Congress is poised to support significant funding to establish a Center that improves patient safety through research and dissemination of relevant knowledge and strategies. The IOM report highlights the need to include the role of human error in the Center's patient safety research agenda. Defining best practices around support systems for team training and crew resource management applications in health care is recommended as one of the Center's product lines. To accomplish some of its work, the Committee suggested that the Center for Patient Safety establish Centers of Excellence, each of which would have a specific focus such as research on interdisciplinary teams. Taken a step further, through the Center's research and dissemination activities, information designed to reach all health care providers should, to the extent possible, reflect implications that recognize and incorporate the interrelationships between various team members. More needs to be known about what predisposes interdisciplinary teams to provide safe care.

IOM Recommendation: *A nationwide mandatory reporting system should be established and voluntary reporting efforts should be encouraged.*

Since the publication of the IOM report, the nature and utility of reporting systems has been the subject of intense discussion in venues ranging from congressional hearings to meetings of professional associations to health care literature. While highly complicated, the purpose, process and substance of reporting systems is directly relevant to the practice of all health care providers. As efforts are pursued to improve reporting processes, whether they follow or deviate from the IOM recommendations, and whether they are initiated at the institutional, state and or federal levels, designing more effective reporting systems and standardizing reporting formats to aggregate, analyze and ultimately inform change to improve patient safety are areas that could benefit from the combined input of nurses and physicians. The two key challenges facing reporting systems, and described in the IOM report, sufficient participation and developing an effective response system, are difficult to address without the combined expertise and commitment of the nursing and medical professions. For example, training in event recognition, with clear standards, definitions, and ease of reporting increases the likelihood of reporting events (Kohn et al., 2000, p. 99). Given the interdisciplinary nature of care delivery, training that addresses event recognition in functions such as handoffs between nurses and physicians could be a collaborative focus for safety improvement by nursing and medicine.

IOM Recommendation: *Congress should pass legislation to extend peer review protections to data related to patient safety and quality improvement that are collected and analyzed by health care organizations for internal use or shared with others solely for purposes of improving safety and quality.*

With one exception, every state has statutory protection of peer review committees although there is considerable variation in the nature and scope of

these statutes. While this recommendation has complex legal overtones, it does have relevance to collaborative nurse-physician efforts to improve patient safety. Moving beyond the broad language of the IOM recommendation, analysis of errors for quality improvement purposes should involve all relevant disciplines. The composition and orientation of committee discussions such as Mortality and Morbidity (M and M) Conferences is a case in point. Mandated in 1983 by the Accreditation Council for Graduate Medical Education, M and M conferences are conducted to review cases of patient death or morbidity in order to determine areas where adverse outcomes could have been prevented. Historically, this analysis of errors has consisted of discussions involving only physicians, using a hierarchical format in that discussions are often directed by senior members of the medical staff and, intended or not, can be blame laden.

This structure and meeting composition for analyzing adverse events exists in spite of the fact that physicians function in care systems involving interface with and direct engagement of other providers in care processes. Consequently, analysis and recommendation for safety improvement efforts produced through these kinds of conferences may be significantly constricted. Physician-only discussions, focusing on strategies directed toward physician actions, artificially removes the analysis from a systems context in which these actions actually occurred. Establishing a framework for including multidisciplinary input, in the context of these and other similar meetings should facilitate a broader systems perspective that may produce system-wide change with significantly more impact on patient safety improvement. Committees established for the purpose of patient safety improvement, across the spectrum of delivery systems, should include leadership by health professionals with training in collaborative teamwork behavior and systems thinking and require the participation of various disciplines in order to effectively analyze and ultimately prevent compromises in patient safety.

IOM Recommendation: *Performance standards and expectations for health professionals should focus greater attention on patient safety.*

This recommendation is discussed in the context of both individual provider competency as well as the collective efforts of organizations to improve performance. Recognizing that professional organizations can help to shape the orientation and actions of their members, the IOM report urges professional societies to establish permanent committees charged with safety improvement. Explicit actions for these professional society-based committees are prescribed, including: 1) to develop patient safety curricula; 2) to disseminate patient safety information to organization members through publications and presentations; 3) to develop community based collaborative initiatives for error reporting, analysis and implementation in conjunction with the Center for Patient Safety; 4) to recognize patient safety considerations in practice guidelines, and 5) to collaborate with other professional societies and disciplines in a national summit on the professional's role in patient safety.

Whether safety improvement is emphasized in clinical education associated with academic endeavor or through continuing education available through professional associations, information designed to "emphasize better communication across disciplines" (Kohn et al., 2000, p. 147) merits incorporation. Building on the general direction of this recommendation, where nursing and medicine overlap in care delivery, curricular components developed by professional organizations to improve safety in those care processes should reflect the input and roles of both groups. For example, to the extent that the American Medical Association or the American Nurses Association pursue curriculum development on patient safety, they should consider how input from representatives of their counterpart organization can contribute to a more comprehensive curriculum. Similarly, more specialty associations such as those representing emergency physicians and emergency nurses should explore joint curriculum development efforts. Co-developed safety improvement content could incorporate information important to both groups as well as more accurately reflect the preferred nature of day-to-day interactions of clinicians from both groups.

In addition to training efforts, selected safety improvement research agendas could also be coordinated across professional societies. Also,

association-based publications and presentations designed to improve patient safety should embed the actions of members of the discipline within a systems context. This orientation encourages members to contemplate safety improvement beyond the boundaries of their own discipline to recognizing the relevance of collaboration in health care environments to improved safety. For example, medication use is a highly complex process involving different departments as well as providers from various disciplines. In spite of this, the processes for medication use are taught to students through discipline specific educational programs isolated from each other. On first blush this process may seem mundane. However, what is known with certainty is that medication-related errors are one of the most commonly occurring errors in health systems resulting in patient injury and death. Too often, multi-step processes carried out in complex systems are at risk of unanticipated and unplanned outcomes detrimental to patient safety. "As recognition has grown that errors are caused by failures in systems, interdisciplinary collaboration may become increasingly necessary for redesigning complex systems of care" (Kohn et al., 2000, p. 146). For the same reasons, developing practice guidelines can benefit from a more interdisciplinary approach (Kohn et al., 2000).

The IOM report gives special attention to associations that can exert broad influence not only over individual members but also over other entities, such as educational programs. Organizations representing nursing and medical education programs across the country can impact patient safety by initiating or expanding expectations regarding the inclusion of educational content related to interdisciplinary communication and teamwork. While not specifically mentioned in the IOM report, the same can be said of federal programs that fund the health professions educational enterprise. Furthermore, while the IOM calls for an interdisciplinary national summit focusing on safety improvement, upon reflection, ongoing organization-level efforts should be instituted that would establish inter-organizational collaboration and shared agendas intended to continuously address patient safety.

IOM Recommendation: *Health care organizations and the professionals affiliated with them should make continually improved patient safety a declared and serious aim by establishing patient safety programs with a defined executive responsibility.*

Patient safety programs should, among other things, establish interdisciplinary team training programs, such as simulation, that incorporate proven methods of team management. Extrapolating from this recommendation organizational values that embrace patient safety as an institutional priority and collaborative efforts to achieve that end communicate important expectations. Senior level leadership in organizations, including clinical leaders of both nursing and medicine, should expect collaborative, team-oriented behavior that forwards the goal of improved patient safety. In addition to this expectation for all nurses and physicians associated with health care organizations, adequate training resources to help incorporate proven methods of managing work in teams and the use of interdisciplinary team training programs must be provided. As organizational delivery characteristics shift, such as significant changes in staffing mix, health care professionals are expected to work in a new dynamic. Job and safety system redesign should incorporate input from both individual and interdisciplinary teams input. For example, simplifying processes for information exchange between nurses and physicians and standardizing processes through the use of standard order forms or protocols should be developed with both disciplines involved. Furthermore, methods to include patients in safety improvement efforts could benefit from collaborative discussion, in conjunction with consumer representatives.

Design Elements for Safe Systems

Designing safety into health care systems is as important in outpatient settings as it is in hospitals, although the former has to date, received considerably less attention. The IOM report concludes that cultural barriers to improving patient safety are not setting-specific. That is, across organizations, there is a "high premium placed on medical autonomy and perfection and a historical lack of interprofessional cooperation and effective communication" (Kohn et al., 2000, p. 165). Drawing on knowledge developed from other industries, the IOM committee identified five principles appropriate

to designing safe care, two of which are particularly relevant here; promoting effective team functioning and creating a learning environment.

Regarding team functioning, to the extent that nurses and physicians are trained separately, it is difficult for individual clinicians to capitalize on the capabilities and recognize the limits of the other profession. "It is the clear understanding of other types of practitioners, together, with the ability to combine forces that can best ensure the desired outcome: a patient's optimal health" (Holmes & Osterweis, 1999). Lacking this knowledge, clinicians function in proximity and parallel to each other in contrast to true team approaches that allow roles to safely intersect in the provision of patient care. "In an effective interdisciplinary team, members come to trust one another's judgments and attend to one another's safety concerns" (Kohn et al., 2000, p. 173). Achieving safe patient care that results from the interaction of different disciplines is difficult to accomplish without adequate understanding of the contributions of different providers and mechanisms that enhance interaction among them. Isolated training prevents nurses and physicians from "work(ing) together to share authority and collaborate in problem solving" (Kohn et al., 2000, p. 179). Solving problems is a constant in health care environments and effective, lasting solutions typically require various disciplines using systems approaches. Capitalizing on the different orientation and functions of nursing and medicine, interdisciplinary teams can bring different perspectives to evaluating vulnerabilities in care systems, especially when new technologies are introduced, care processes are altered, or organizational level changes occur. Interdisciplinary simulations that incorporate both technical and interpersonal skills and dynamics may be one vehicle for building team effort that improves patient safety.

In designing learning environments to improve patient safety, reprisal for reporting error is eliminated and a working culture that allows free flow of communication, regardless of authority gradient is established (Kohn et al., 2000). These two characteristics of a safe care system may be among the thorniest to achieve. Developing appropriate communication patterns and eliminating blame as a response to error starts well before professional practice. This orientation must be developed in medical and nursing schools and reinforced throughout student and professional life. Fundamental to improved communication is respect for the contribution that professions bring to health care (Kohn et al., 2000

Efforts to Improve Safety in Other Industries

The IOM report asserts, as does other literature, that efforts to improve patient safety can be informed by approaches and initiatives well underway in other industries. Without question, differences exist between the nature and complexity of health care and other industries. Nevertheless, many complexities such as human-technology interaction, human-to-human interaction and stress-laden situations are common to certain work environments.

Strategies to improve patient safety will not entirely derive from outside of health care. So too, patient safety improvement will be impeded when efforts do not appropriately draw on lessons learned in other industries. Safety improvement techniques and solutions used by other disciplines in other environments merit evaluation for their use in health care. Lessons can be extracted from environments where safety is a priority and work is completed by teams comprised of individuals from different backgrounds. For example, fueling aircraft and loading munitions on aircraft carriers are risk laden activities that typically involves scores of individuals with different responsibilities, different rank and different education. Similarly, aviation is looked to as a model for safety improvement in health care, with articles and books speaking to similarities and learning opportunities that derive from this industry (Helmreich, 2000; Helmreich & Merritt, 1999; Sexton, et al., 2000). This idea of acquiring information from other disciplines is expressed as a shift away from research and development (R & D) to acquisition and development (A & D) which is used at high technology companies in Silicon Valley to describe the practice of borrowing and building on what others have done in order to maximize knowledge (Schrage, 2000).

In aviation, most errors have been identified as including breakdowns in crew coordination,

communication and decision-making (Helmreich, 2000; Helmreich & Merritt, 1998). While teamwork is required in both aviation and health care, knowing these precursors to error, the aviation industry has been intently analyzing the role of these human factors in performance. Safety improvement has moved well beyond establishing the need for the technical skills associated with flying. Crew Resource Management (CRM), used by virtually all airlines around the world, embodies team training of the cockpit crew, study of human error, leadership skills, decision making, plan review, and modification processes. CRM training includes communication skills such as polite assertiveness, participation, active listening and feedback. The orientation of CRM moves from focusing on individual performance to focusing on team performance. More recently, CRM concepts have unfolded to embrace not just individuals in the cockpit, but all players including flight attendants, air traffic control and the corporate enterprise. CRM uses all available resources to achieve safe flight operations. Would passengers knowingly accept anything less? These non-technical aspects of job performance are considered so critical to aviation safety that pilots are considered for employment not just based on their technical skills but also based on their ability to coordinate activities, learn from error, and recognize that others can contribute to problem solving.

Barriers to Nurse-Physician Collaboration

Collaboration is defined as a "joint communicating and decision-making process with the expressed goal of satisfying the ...needs of the patient while respecting the unique qualities and abilities of each professional" (Colluccio & Maguire, 1983, p. 63). Embedded within successful collaboration are trust, knowledge, shared responsibility, mutual respect, good communication, cooperation, coordination and optimism (Arcangelo, et al., 1996). Some of the elements of collaboration, such as effective communication across disciplines, have been correlated with improved patient outcomes (Aiken, et al., 1994; Knauss, et al., 1986; Shortell, et al., 1992).

Over 30 years ago, and prior to the births of many of our current nursing and medical students, an article titled "The Doctor-Nurse Game" was published in the Archives of General Psychiatry (Stein, 1967). The object of the "Doctor-Nurse game" was to preserve the interactive roles of the physician as sole decision maker and team leader while allowing the nurse to make recommendations as long as they were couched in a passive demeanor. Open disagreement was deemed unacceptable. Physicians might require advice from nurses but the interaction was couched in ways that protected an omniscient and all-powerful role. Nursing students were educated to avoid independent decision making at all costs. Larson (1995) sites a study that was conducted in the same year "The Doctor-Nurse Game" was published on 22 nurses who were given a telephone order by a physician that involved an obvious drug overdose. Twenty-one of the nurses said they would have given the drug without question. While educational programs may have changed over the last generation, have they changed enough?

In health care delivery systems, care has been traditionally dominated by physicians. Interdisciplinary education reflects a shift in this orientation. Often, those who exercise power and sole decision-making authority in a hierarchy will not easily give up their position, but will pursue policies that continue their dominance in the organization (Brindle & Mainiero, 2000). This traditional model of health care delivery no longer meets the needs of delivery systems or patients as the provision of all health care has become too complex to rest in the hands of a single profession. Ironically, as the complexity of health care has increased in terms of how and even where care is delivered, little progress has been made in decreasing the educational and practice isolation of the medical and nursing disciplines responsible for fulfilling key functions in this increasingly intricate care web. Physicians and nurses, as students and practitioners, occupy the same physical "patient care space" but frequently communicate ineffectively and indirectly. Furthermore, increasingly consumers are participating in their care decisions engaging all providers in new ways. Developing effective, interdisciplinary teams is one way to align delivery systems to better meet patient needs and improve safety.

In academic settings, certainly not all academic administrators or health professions faculty value interdisciplinary educational efforts. As Fulginiti

(1999, p.11) suggests, "…. often a strong belief exists among some educators that interprofessional offerings are soft sciences that distract from important content and dilute time in their own disciplinary curriculum". Collaboration taught and modeled within a systems context is frequently absent. Interestingly, nurses and physicians are, at one level, taught in great depth to think about interrelated components of systems (e.g., respiratory, cardiac). Nevertheless, this concept, commonly recognized at the physiological level, is not discussed or demonstrated at the team and organizational level

Barriers in academic environments include scheduling difficulties and issues of control as well as the commitment to sustained efforts that can inform evaluation of student outcomes. Moreover, competition rather than collaboration between the professions becomes evident even to students who often witness interdisciplinary competition for resources such as lab time or clinical placement opportunities. Accommodation that could signify valuing is replaced by winners and losers.

Even the nomenclature disciplines use can create communication problems. Some terminology is discipline specific and may convey little or no meaning when observed by a member of another discipline. For example, nurses often ask patients to rate their pain on a scale of 1 to 10 while physical therapists use a pain scale that ranges from 1 to 5. Pain designated as a level 3 carries very different meaning to these two providers and can contribute to inappropriate interventions. Alternatively, practicing of evidence-based medicine as a research and practice domain may be viewed by some as including or excluding evidence-based nursing. Yet, the latter is a domain of effort for the nursing profession as much as the development of an evidence base is for the medical profession. Nevertheless, there can be little doubt that some evidence that exists or is yet to be developed could rightly inform the practice of both professions. Furthermore, even as the merits of collaborative practice are taught, evidence of its impact on patient safety needs to be built.

Meanwhile, nurse-physician collaboration and the challenge of team building to improve patient safety is a concern resonating beyond U.S. borders. For example, articles in the British Medical Journal (2000), call for more innovation and flexibility in teamwork but acknowledge that altering traditional barriers between professions causes heightened tensions. Attention in the British Medical Journal is specifically directed toward the accreditation of health care educational program's lack of interdisciplinary courses and consequently are still based on outdated models of health care delivery.

Collaborative Education Approaches to Improving Patient Safety

"We all share the same sky, we just have different horizons."

- A journalist commenting on the formation of the European Union.

A natural starting point for enhancing collaboration begins in educational organizations given that "the norms and values of the profession are exemplified by its senior members and passed on to recruits" (Helmreich & Merritt, 1998, p. 30). Two organizations pivotal to medical and nursing education, embrace in their public documents important elements of teamwork. The Association of American Medical Colleges' "Learning Objectives for Medical Education" lists four broad educational goals, including physician altruism. This goal is defined as including "an understanding and respect for the roles of other health care professionals, and the need to collaborate with others in caring for individual patients and in promoting the health of defined populations (AAMC, 2000, p.7). A review of the American Association of Colleges of Nursing document titled "Essentials of Baccalaureate Education for Professional Nursing Practice" stresses the importance of collaboration with interdisciplinary health care teams and notes that a key competency includes communication as a basis for building interpersonal relationships as well as the ability to establish and maintain effective working relationships within an interdisciplinary team. Skills viewed as essential to role development of nurses include communication, collaboration, negotiation, and evaluation of interdisciplinary work as well as the application of outcomes-based practice models. (AACN, 1998)

The history of nursing and medicine is laden with conflict that has at times corroded relationships and

heightened tensions between the two disciplines. In spite of this history, and conflict likely to emerge in the future, interventions to analyze and resolve conflicts where possible provides a positive venue for relationship-building between the two professions around at least one shared goal: putting patients first. Recognizing and working toward this goal over the self interest of disciplines involves building the interdisciplinary team's ability to identify and resolve conflict by developing a shared repertoire of conflict resolution skills. The application of knowledge and skills around conflict resolution is probably as essential to interdisciplinary professional association interaction as it is to educational models designed for interdisciplinary student learning. Characteristics important to resolving conflict (both real and perceived) which are directly relevant to safety improvement include: 1) team members who are comfortable exploring sources of ongoing tension; 2) time to build dialogue skills so team members can address sources of interpersonal conflict and recognize their own role in it; 3) building a shared understanding of conflicts; 4) developing plans for new ways to work together and interact, and 5) agreement and follow through that prompts new behavior (Cobble & Huffman, 1999).

Traditional education of nurses and physicians in isolation from one another creates an orientation that does not value or reward team collaboration. Concrete incentives in educational programs designed to evaluate or even promote effective interdisciplinary teamwork are rare. Content mutually beneficial to nurses and physicians includes development of communication skills, not just with members of one's own discipline but also effective communication with other providers. Nurses and physicians need to regard their interactions with each other in fundamentally different ways and systems need to be designed that support these interactions. To a nurse giving patient care, being summoned to the nurses station to respond to a physician's request for information may well be perceived as a burden. To a physician called about a patient in the middle of the night by a nurse, the substance of the call may be viewed as a non-essential sleep interruption. Neither scenario assigns value or respect to the nature of the interaction. Communicating information to other health care team members in these contexts is often viewed as disruptive rather than useful and central to the provision of patient care and the protection of patient safety.

Interactions characterized by unwillingness to question and resistance to being questioned, disregarding the opinions of others, and failure to consider alternatives must not trump actions essential to ensuring safe care. Time spent with other health care team members in problem solving and building skills to manage patient problems is a care process and merits both learning and valuing. Given the organization and complexity of patient care, with all the accompanying risks to patient safety, Fulginiti's (1999, p.15) question, "shouldn't all...health care providers know that they cannot deliver care alone?" is at the crux of the interdisciplinary educational enterprise.

Summary

The IOM asserts, "although almost all accidents result from human error, ...errors are usually induced by faulty systems that set people up to fail" (Kohn et al., 2000, p. 169). Essential to redesigning delivery systems using interdisciplinary team approaches to care, is the redesign of educational programs. Both efforts have the fundamental goal of improving patient safety. Relevant collaborative efforts between nursing and medicine must put patient needs ahead of individual provider and professional self-interests. Without change in the values, culture, and content of academic, continuing education, and practice environments, professions set their members up to fail as effective team members and increase the likelihood of compromised patient safety. Fundamental to improving patient safety is the need for nurses and physicians to learn and to work together. Ignoring the "white space" between nurses and physicians – the seemingly impermeable boundaries around professions -- commits these two provider groups to a practice culture that is unsafe for patients. Patient safety improvement cannot be achieved when health care professionals stand in proximity to one another, yet function worlds apart.

RECOMMENDATIONS

Practice Settings:

1. Develop structures and practice expectations that foster nurse-physician collaboration in which

responsibility for patient safety improvement among health care providers is shared in the health care delivery setting. Strategies such as conducting co-led meetings and including both providers at all organization levels where patient safety is considered.

2. Evolve/Expand meetings on patient safety improvement that incorporate interdisciplinary teams that analyze adverse events and investigate latent errors from a systems perspective.

3. Incorporate key elements of interdisciplinary models as a standard of practice related to patient safety.

4. Train providers in teams to heighten awareness of components of collaboration to improve patient safety. This training should include team evaluations of care processes and team evaluation of errors and near misses.

5. Conduct interdisciplinary research that explores characteristics of collaboration and patient safety improvement.

Educational Programs:

1. Integrate components of nurse and physician education. Train in teams those who are expected to work in teams. Require interdisciplinary experiences rather than offering courses only as electives. Content relevant to patient safety and error reduction with an emphasis on collaborative approaches to deliver care with a systems orientation should be taught:

- Curricula should be co-developed and co-taught by nursing and medicine faculty in educational settings *as well as* through continuing education in practice settings.
- In addition to didactic experiences, interdisciplinary simulation techniques can be employed in educational programs.
- Consider how academic programs currently socialize students into respective professions and look for values and cultural characteristics that foster turf battles and isolation.

2. Evaluate the effectiveness of the interdisciplinary model as a standard of educational programs.

Government:

1. Convene joint meetings of federal entities with responsibility for policy decisions that affect service delivery settings and health professions education to intensify programmatic focus on patient safety.

2. Encourage health services research focused on interdisciplinary care models that build an evidence base for practice. Evaluating outcomes of interdisciplinary practice and education should be a high priority to promote patient safety and enrich research on safety improvement.

3. Develop a Demonstration Program that would identify, publicize information, and reward institutions that have practice environments that require nurse-physician collaboration to reduce errors with demonstrable outcomes.

4. Encourage State Boards of Medicine, Nursing and Pharmacy to take advantage of lessons learned from their study of error and disseminate the information more widely. The boards should work together, share data and identify patterns of error that could be used to inform error reduction efforts in the health care industry.

5. Foster collaboration among professional associations to improve patient safety and reduce health care errors. Medical and nursing professional associations should prioritize error reduction in patient care and consider strategies that support collaborative, agreed upon outcomes and team-delivered care as a means to this end. Inter-organizational steering committees with shared governance structures and consumer representation could be established to guide team-delivered care and help to sustain professional interest in error reduction. Activities could include for example, development of integrated approaches to relevant continuing education offerings.

6. Develop a clearinghouse of information to provide objective, current information on models of physician-nurse collaboration that contribute to patient safety.

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Managing Error for System Improvement

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The human cost of medical error was essentially "hidden knowledge"[1] until the recent Institute of Medicine (IOM) report " To Err is Human", [2] made public the annual medical error casualty rate. The resultant intense public interest has spurred private and governmental efforts to reduce this patient safety risk.

The IOM's suggestions for risk reduction included the explicit recommendation that health care organizations establish patient safety programs incorporating three essential elements: (1) non-punitive systems to encourage error reporting and analysis, (2) incorporate well-understood safety principles, and (3) provide interdisciplinary team education and training. This chapter will address some critical factors within the first two of these three elements.

Non-Punitive Systems to Encourage Error Reporting and Analysis

Regrettably, the strong health care tradition of emphasizing individual blameworthiness discourages error reporting. What is needed, instead, is a new tradition or safety culture where employees are encouraged to discover and report unsafe conditions and actions without fearing the effects of a "punitive perfectionism".

Although the term "safety culture" is often discussed, there is significant confusion about what it means. One view considers that culture is primarily defined by an organization's behaviors, rather than by some emergent property of its beliefs and values. This pragmatic approach focuses more on what is initially controllable such as structures and processes rather than collective values[3]. In this view, an organization's safety culture draws heavily from the procedures and practices that help maintain a mindfulness of its performance, including incident reporting, auditing and direct observation.

The strong link between an organization's culture and event reporting has been considered by, a number of authors[4,5,6] Westrum[5] has characterized this relationship into one of three general types according to an organization's response to an adverse event:

Pathologic Culture - *Shoot* the messenger

Bureaucratic Culture - *Enforce* or add a specific rule

Learning or Generative Culture - *Seeking to learn* from this event. Is there a more general lesson to be learned?

Expanding the availability of safety information requires a careful balance of two conflicting goals: voluntary reporting and disciplinary action. Achieving this balance requires that disciplinary strategies incorporate a significant human factors component. Such methods accommodate the expected occurrence of human error in complex systems, including organizational/systems failure contributions, while still acknowledging the appropriateness of disciplining the rare employee who acts recklessly.

As legally defined, a person's action is considered reckless if there is conscious disregard of a substantial risk of causing harm. When, however, the person lacks this risk awareness, even though the risk *should have been* recognized, the action is considered negligent[7]. In other words, the negligent person mistakenly does not foresee, rather than consciously ignores the danger. Recklessness is intentional risk taking, while negligence is the equivalent of ordinary human error. Perhaps, given the negative baggage carried by the term "negligence", the phrase "human error" might be preferable. Setting the disciplinary threshold at recklessness both supports a high professional conduct standard and promotes error reporting, particularly of near misses, since it eliminates fear of inappropriate punitive disciplinary action[7].

Lucas[8,9], Berwick[10], and Reason[3] have emphasized the importance of creating an organizational environment where error management efforts are directed at learning how the system actually operates as opposed to how management thinks it is operating, and where events can be reported in an open and free manner. It is essential that there be no adverse consequences attributed to those submitting event reports, as well as those involved in non-reckless behavior. In order to accomplish this, discovery of a non-reckless error should be uncoupled from any evaluation of individual performance.

How do we translate these human factors and legal principles into practice? In health care, all too often, professionalism and accountability are interpreted as a requirement for perfection. David Marx, an attorney with expertise in aviation engineering and in human factors, suggests an approach called a "just system", recognizing human error as a natural and expected element of human behavior. This is not a "blame-free" system, however, as a line is drawn between human error and blameworthy conduct. If the disciplinary threshold is kept as simple and precise as possible, it enhances an understanding of the justice of the system.[7]

Table 1 summarizes, in decision table format, some important issues identified by Marx concerning culpability, identifiable behaviors, and the management of these behaviors.

The following case example of a near miss event illustrates application of the table: A ventilator alarm signal was not responded to for over 4 minutes by the ICU nurse, who, "did not hear the alarm", and who was caring for one other high acuity patients in different areas of the ICU. A second nurse, caring for a patient in an adjacent cubicle, noticed the alarm and responded before there was patient harm. The responsible nurse brought this event to the attention of the unit head who evaluated its circumstances in two separate parts: the nurse's performance, and the system's performance. (The present discussion focuses on evaluating culpability; a later section attends to the system issues.) There was no evidence that the nurse had a purpose to harm, or knowledge that her action or inaction put the patient at risk of harm. Nor did she act recklessly with a conscious disregard of a significant and unjustifiable risk. Her behavior was not blameworthy. Yes, she should have known that the patient's alarm was ringing and she should have responded to it. This was a human error. In addition, there was no evidence of intended behavior, such as attending too closely to unrelated matters, which would be viewed as at-risk behavior. The system's contribution to this near miss event will be reviewed in the context of the later discussion on causal analysis.

Beyond the issues of blameworthiness, it is important that feedback to staff be provided on process improvements that result from events reported. Such feedback is essential to assure continued reporting. Additionally, some means of acknowledging input activity, for example, summary reports on a bulletin board, makes the process more accessible to staff. It encourages employees to regard the reporting system as their own. No one wants to continue to voluntarily feed information into a black hole.

In a medical setting in which there is a new learning culture, there may be as much as a ten-fold increase in reporting[11]. The authors found that when such an event reporting system was established within the blood transfusion service at a large public hospital there was this same ten-fold increase in reported events. This was a welcome circumstance, and although its desirability might initially seem counter-intuitive, the change reflected an important increase in information about the system's weak points.

The term "Detection Sensitivity Level" (DSL) is intended to reflect the level of an organization's event reporting, a high DSL being desirable. Conversely, the term "Event Severity Level" (ESL), represents the level of patient risk associated with an organization's reported events. While the DSL may remain high, the event severity level (ESL) of reported incidents should decrease over time as corrective actions are implemented[12]. A decrease in event severity coupled with increased event reporting has been described in high hazard industries including nuclear power[13] and aviation[3]. British Aviation's information systems (BASIS), has demonstrated a two thirds decrease in high risk events associated with a three-fold increase in event reporting.[3]

Table 1: Decision Table for a Just System						
Culpability Continuum	Intentional Risk Taking	Y			N	
	Purpose toward undesirable outcome	Y	N			
	Knowledge that outcome will occur		Y	N		
	Conscious disregard of significant and unjustifiable risk that outcome would occur			Y	N	
	Should have been aware of significant and unjustifiable risk that outcome would occur				Y	
	Intended behavior				Y	N
Manageable Behavior	High Culpability Behavior -- Purpose	X				
	High Culpability Behavior -- Knowledge		X			
	High Culpability Behavior -- Reckless			X		
	Human Error -- At-risk Behavior				X	
	Normal Error, No Culpability -- Product of current system design					X
Manage Through	Manage through disciplinary action	X	X	X		
	Understanding what are the at-riosk behaviors Add/Dec. Incentive for desired/undesired Increase situational awareness				X	
	Manage thjrough changes Processes, procedures, training, design, environment					X

A preponderance of "benign" errors in medicine from failures to follow safe practice leads to a deceptively low morbidity. Even with a projected annual rate of 40,000 to 98,000 hospital fatalities nationally attributed to medical error, the potential for harm remains obscure, because sentinel events in any single institution remain infrequent. In this context, the concern that "nothing recedes like success"[14] speaks to the potential difficulty of maintaining an ongoing commitment of resources to support error management. How is such a commitment maintained? By recognizing: (1) That error management is a continuous process (it has been likened to a continuing guerilla war [3]) not a finished product; and (2) Near misses, rather than sentinel events are a primary source of information for system improvement and maintenance. Near misses are much more abundant than sentinel events, they are generally less burdened with the emotional charge of an harmful event and they provide insight into human recovery, since by definition, there is recovery - they do not go on to a bad outcome.

Safety Principles: Human Factors and Error Management

Along with event reporting, what are some of the other specific methods that have proven useful in support of error prevention and recovery, the two critical elements of error management?

Methods to Identify and Study Errors

There are a number of methods to identify and reduce the risks of human error. Among the methods used are direct observation/ audit, accident analysis, simulation, manual record review/ chart audit/ electronic surveillance, and event reporting. In general, a combination of methods will more effectively provide information regarding error than any one "ideal" method. For example, in aviation, three major approaches are often combined to understand crashes or to sustain system improvements. The National Transportation Safety Board investigates crashes and incidents where harm to persons has occurred; the Aviation Safety Reporting System gathers near miss data, and a mature simulation infrastructure has been developed for research and training.

Observation / Audit

One approach is direct observation by skilled individuals in the real operating environment. This is a well-established way to address human error in its actual setting. At the University of Southern California, the blood bank and nursing staff developed a multi-disciplinary team approach directed at reducing patient identification errors through improved compliance with standard procedures. The program employed periodic concurrent audits, including direct observation of patient identification procedures. With feedback about deviations from protocol and active educational efforts, adherence to patient identification procedures improved gradually from 50% during a pilot study, to nearly 100% by the 125th audit.[15]

A limitation of this type of direct observation is that observation itself may alter the circumstances studied; another is observer error. Also, the enduring effect of such improvement requires a sustained intensive effort, particularly given employee turnover.

Accident Analysis

The second approach to error identification and prevention is the analysis of accident data. This has been an important source of information, despite the limitations of hindsight bias and incomplete data [16]. Accident data is utilized in the local analysis of "sentinel events", and in mandated central databases. In 1975, the Food and Drug Administration (FDA) first required the central reporting of transfusion-associated fatalities. This database has been extensively studied by a number of investigators[17,18,19,20,21,22]. In an analysis of fatalities reported to the FDA over a 10-year period, Sazama[21] determined that errors leading to fatality were most often "managerial" or system errors, rather than isolated human error.

In a study of 150 fatalities subsequently reported to the FDA database over a two-year period, Mummert and Tourault[22] concluded that nearly one-third could have been prevented by adherence to proper procedure. Interestingly, a failure to follow procedures is also responsible for one-third of major air carrier accidents[16]. As pointed out by Nagle in the analysis of aviation accidents, even with categorization of error data, if it is not known why someone "failed to follow standard procedures" *i.e.*, "a lack of understanding of the 'why,' " the design of an effective remedial strategy remains problematic[16]. In this regard, Nagle has stressed the need for a model of human error to be used in conjunction with error data collection and classification. The modified Einthoven classification scheme[12] discussed later in the chapter incorporates such a model.

Beyond prevention, managing an error in progress to limit an adverse outcome is of fundamental importance in system design and training in error-critical activities. Failure to identify a transfusion reaction in progress contributed to many of the 150 transfusion-related fatalities discussed by Mummert and Touralt[22]. In some cases signs or symptoms were treated, but the incompatible transfusion was not identified as the cause of the problem and was not discontinued. These authors also reported that in several cases, signs such as hemoglobinuria were noted without apparent recognition of their significance. Time lost in detecting a problem, improperly identifying its cause, as well as delay in

implementing corrective actions are recognized as crucial issues in safety management.[20] Although this is recognized in medicine, as can be seen in the studies of the FDA central database, it has not yet been broadly or effectively dealt with.

Simulation

Simulation of an event is another method for development of error prevention and containment. It provides a means to experiment with a variety of environmental conditions such as workload, stress, equipment design, staffing, and information support, The simplification inherent in the laboratory, although often advantageous, may, however, limit understanding of complex systems. Although, with the use of high fidelity simulation, which closely mimics actual conditions, many limitations can be eliminated. If rich enough detail about actual events exists, a reproducible, reliable, simulation emphasizing selected aspects of a particular case may be created and run any number of times to collect data on human, technology, or systems performance. Practitioners at various levels of training or certification can be expected to be differentiated by performance assessment tools. Currently, complex problem solving, decision-making, and team level behavioral measurement tools are being developed.

Some "low fidelity" simulations may, however, still be effective in reducing error in focused tasks. For example, the announced introduction of simulated "benign" errors into routine operations has been an effective means for increasing error detection by increasing vigilance. Taswell[23] demonstrated that by modifying work to demand staff attention in looking for known, purposely introduced clerical errors and by providing positive feedback when they were found, he not only achieved an increased detection of the introduced errors, but also increased the detection of real, previously undetected errors from as few as four in the first three months to as many as seventy-three in the final three months of the one year study.

Record Review/Chart Audit

A fourth approach to identify errors is to review patient records. The review of such records has been the most traditional means of performing quality assurance checks and documenting patient outcome. The chart or record provides evidence of actions performed or of missing information. Auditing charts or records against predetermined criteria can be a valuable method of identifying errors and near miss events. Classen[24,25] and colleagues have successfully used a sophisticated automated hospital information and record system to identify adverse drug events that would have otherwise gone unreported. Record review and chart audit are potentially limited to captured information. Despite this limitation, James[26] and, Gardner[27] in other discussions in this volume present convincing evidence for the power of electronic record surveillance.

Event Reporting

A fifth approach to compiling information for the study of error is the event report, including self-reporting as exemplified by the Aviation Safety Reporting System (ASRS) operated by the National Aeronautics and Space Administration (NASA) for the Federal Aviation Administration (FAA). This is a no fault, confidential, voluntary, self-reporting system, in which pilots and air-traffic controllers report near miss occurrences. Confidentiality and indemnity for non-criminal or non-reckless acts are important features. Since there is no disincentive to report, this approach optimizes access to information provided by the incident reporters themselves.[16]

The distribution of causes in these near miss events is similar to those identified in the much rarer tragic accidents investigated by the FAA.[16] The much more frequent near miss events have been prevented from developing into full-blown accidents by planned barriers such as redundancies, or by unplanned recoveries. A drawback of voluntary reporting systems is the variability of reporting by different individuals. Even though quantitative event rates are not a strong feature of voluntary reporting systems, they have three clearly identifiable and invaluable functions[28] relevant to patient safety programs:

Modeling of new and unique as well as troublesome events.

Monitoring of events including evaluation of the effectiveness of any corrective system changes

Mindfulness of the potential for error and its effects on patient safety. This is perhaps the most important aspect of event reporting since it has the capacity to fully engage the staff, and enhance the safety culture.

Classification of Events

Regardless of the method used to identify errors, the errors need to be classified once they are discovered. What are the elements of events, both near misses and major misadventures, that should be classified and studied? All events are nested within the context of what happened: where in the process they occurred, when they happened, and who was involved. Although investigation of all these event elements is necessary for complete understanding, most efforts concentrate only on describing what happened. There is little evidence of insight regarding the causes of why the event occurred. The lack of knowledge of the "why" could indicate that the corrective actions taken may be inappropriate or unrelated to the actual cause of the event. The following section discusses two widely used schema for the categorization of errors. In the subsequent section a causal classification scheme anchored in these schema is described.

Categories of Error

Reason[3] has identified two major categories of failures or errors that occur in complex systems: active and latent. It is the active failure that we most often associate with human error. Since active errors derive from human fallibility they may be reduced but never completely eliminated. These errors are linked with the individuals at what has been called the "sharp end" or the front line of the system. Staff nurses virtually define the sharp end of health care. Latent failures are the less often-recognized delayed-action consequences of technical design or organizational issues and decisions. These latent failures are often initiated at the upper levels of an organization. Accidents or major misadventures with adverse outcomes occur when latent errors or system considerations combine with an active human error. Error researchers stress the importance of examining both human and active failures, as well as the underlying latent or system, failures.

Active Failures or Errors

Active errors are tied to how our brains operate and to the resultant behaviors. A widely used taxonomy for classifying these different types of behavior has been developed by Rasmussen. [29,30] This scheme differentiates skill based, rule based, and knowledge based behaviors.

Skill Based Behavior

Most health professionals operate in a skill based behavioral mode for all routine tasks, from drawing blood to regular care procedures. These activities become so highly skilled and so routine they can be carried out without conscious thought, as though on automatic pilot. For example, we can drive while listening to the radio or talking to a passenger. Because driving skills are used so often, they can be performed at a very high level of accuracy without error. However there are opportunities for failure when one operates in the skill based mode. Failure may include the omission of an intended change to a routine, or the failure of performing a routine properly due to a distraction, or an interruption. If something distracts from or interrupts the smooth flow of a skill based routine, a skill-based failure may occur. An example of a skill-based error is someone distracted by something in the parking lot and inadvertently locking the keys in the car. Such an error, also referred to as a slip, or a lapse, cannot effectively be remediated by retraining an individual. Retraining is a waste of time since the individual already knows how to perform the task at a very high level of accuracy and retraining is often insulting and ineffective. Simply counseling employees to be more careful is equally ineffective as a means of remediation. However, slips can be prevented or recovered from by redesign of equipment or procedures so that it is harder to make and error, or an error is more readily detected and corrected. For example, feedback mechanisms can be designed into the process that give clues to the individual as soon as they may have made a slip. Job aides such as a template for reviewing patient forms can highlight omissions or inconsistencies and help to prevent slips in the skill-based mode. .

Rule Based Behavior

Rule based behavior occurs at the conscious level within the context of the situation. It is an if-then condition, which involves recognizing the situation, then selecting the proper routine or protocol called for. For example when driving and coming to a stop sign, it must be decided what rules to apply in this situation. If it is a two way stop, there is a given set of traffic rules to follow; if it is a four way stop, different rules hold. Failure in rule-based behavior can occur at different stages in this decision and action process. These failures are often referred to as mistakes. A mistake can occur under two conditions: selecting the wrong rule for a given situation or selecting the correct rule but carrying it out incorrectly. Rule based failures can take place when someone performs a procedure for which they are not qualified. Selecting the wrong rule results from inadequately assessing or verifying the situation. Although most rule based failures are unintended, in some instances an individual can consciously choose to apply a different rule or carry out a task differently than is prescribed by standard operating procedures. This type of action is a violation. Violations can be relatively routine, a "work around" of an inadequate procedure, or reflect organizational culture, *i.e.*, "everyone does it this way". Routine violations also occur when procedures are changed but individuals continue to follow the old procedure. This may also reflect a latent failure in managing the process of change. In many instances, non-reckless rule based failures are subject to remediation through training. In addition they can be reinforced through clearly written procedures and job aides. Rule based failures of verification can be prevented in some cases by redesigning the task. For example, use of a hand held computer and wristband barcode for patient identification and blood unit verification can reinforce that the patient is correctly identified and is matched to the correct unit of blood. Rarely, a reckless individual may choose to disregard risk and carry out a task in a manner contrary to standard safe procedures.

Knowledge Based Behavior

Knowledge based behavior is solving unique problems or selecting a plan of action in a new or unfamiliar setting. Knowledge based behavior most often occurs with new employees. They lack the depth of experience to operate in skill-based mode or to draw from experience to select the appropriate rule or protocol to carry out the task or to solve the problem. Recent graduates and trainees often operate in knowledge based mode because the number of unique or new situations for them is significant compared to the experienced individual or expert. Experienced individuals only rarely operate in the knowledge-based mode. As a result, the expert and the novice are likely to make different types of errors. The beginner characteristically may make a knowledge-based error, while the expert may more likely make an occasional slip or rule-based error. It is possible, however, for the expert to encounter unique conditions and be placed in a situation where they can be subject to knowledge based failures. An example of such a condition would be expert nurses having to move between one make and model of monitoring equipment and another. The skills and procedures used in operating one are not the same as for the other, creating the conditions for an expert nurse to make a knowledge based error. While it may not take an expert as long to become familiar with a new setting as a person with less experience, there is still a need for orientation and knowledge transfer from the previous setting to the new one. This is why it is good practice to have individuals recertified or credentialed when moving to a new job or when assuming new or different operational responsibilities.

Latent Failures

While we may never totally eliminate human, or active errors, we can eliminate the technical or organizational aspects that might set up the health care professional for an active failure. Latent, or system failures, including both technical and organizational aspects, may lie dormant for a very long time. Reason[3] has referred to latent error as organizational pathogens waiting to combine with the right active human failure to have an adverse consequence.

The technical aspects associated with latent failure include such things as the design of equipment, forms, and software, as well as the construction of facilities including difficulties in direct observation of patients, and materials. One aspect of organizational

failure stems from normal management considerations such as the structure of the organization, planning and scheduling, forecasting, budgeting, and allocating resources. The policies and procedures in place in an organization can also be a source of latent failure as is the orientation, training and selection of employees. The informal culture of an organization can be another source of latent failure. These latent failures have the potential of setting up the individual for failure.

Root Cause Classification

A root cause classification model has been developed as part of a medical event reporting system for transfusion medicine based on the Eindhoven Classification Model1.[28] It has three major categories of causes which are grouped as: technical (equipment, software, and forms), organizational (policies, procedures and protocols), and human causes (knowledge based, ruled based, and skill based). The classification of human failures is consistent with the theoretical framework of Rasmussen[29,30] and the latent technical and organizational factors are consistent with the framework of Reason.[3]

Table 2 is the Eindhoven Classification Model for the Medical Domain. The limited number of causal codes (20), provides the potential for trending aggregate data. (Too large a number of causal descriptors makes each event so unique that trends are not readily determined.) Use of a standardized approach for both process codes and causal codes also provides the capability for both internal and external benchmarking. Causal codes are assigned after the investigation is completed and a causal tree, a form of fault tree, has been diagrammed. The event that occurred, or that almost occurred, is placed at the top of the tree, and the question "why did this happen?" is asked five times in order to determine the sequence of antecedent events that led to the top or consequent event. "Why" questioning is ended when the process has left the span of control of the investigating unit.

Rather than "drill down" to the "one root cause", the emphasis is on determining the chains of causes that are almost invariably associated with events of interest. To do this, the question "and why?" (what other decisions or circumstances contributed?) is also asked five times in order to construct the lateral branches of the tree. To illustrate how this classification model works, we will look at the ventilator alarm event previously discussed. After further investigation, a causal analysis was performed, and a causal tree diagrammed.

Figure 1 represents the causal tree for this case. The multiple factors contributing to this event can be appreciated in this diagram. The recovery step, intervention by another nurse, is in contrast to the lack of resident physician response. It points to a possible opportunity for system enhancement but also to a pervasive problem, indicated by the OC code, the designation for organizational culture. Response is not perceived as a shared responsibility. This is consistent with the abbreviated training-OK (organizational transfer of knowledge) and the little time spent training in this area.-OM (organizational management). The opportunity to learn effective teamwork is not pursued.

Why the nurse herself did not respond to the alarm in a timely manner had multiple contributing causes as well. The lack of familiarity with the patient's ventilator and alarm system increased the difficulty of identifying that signal out of the cacophony of sound generated by phones ringing and numerous other alarms. This reflected both organizational transfer of knowledge-HKK and management policies and priorities allowing multiple makes and models of equipment-OM (management priorities). In addition, the isolation status of the other patient being cared for by the same nurse, (including a physically separated location), further reflects the staffing policy and may provide insight into organizational management priorities-OM.

Creation of a monitored central alarm board, the addition of supplemental visual alarms, and standardization of equipment for earlier detection and more timely response and operation, are some of the system improvements derived from this event.

Summary

Patient safety can be improved if errors that are an indication of a system's weak points are identified

TABLE 2: EINDHOVEN CLASSIFICATION MODEL FOR MEDICAL DOMAIN

Code	Category	Definition
Latent Errors		Errors that result from underlying system failures
Technical		Refers to physican items, such as equipment, physical installations, software, materials, labels and forms
TEX	External	Technical failures beyond the control and responsibility of the investigating organization
TD	Design	Failures due to poor design of equipment, software, labels or forms
TC	Construction	Correct design, which was not copnstructed properly or was set up in inaccessible areas.
TM	Materials	Material defects not classified under TD or TC
Organizational		
OEX	External	Failures at an organizational level beyond the control and responsibility of an investigating organization, such as in another department or area (address by collaborative systems)
OP	Protocols/ Procedures	Failures relating to the quality and availability of the protocols within the department (too complicated, inaccurate, unrealistic, absent, or poorly presented)
OK	Transfer of Knowledge	Failures resulting from inadequate measures taken to ensure that situational or domain-specific knolwedge or information is transferred to all new or inexperienced staff.
OM	Management Priorities	Internal management decisions in which safety is relegated to an inferior position when faced with conflicting demands or objectives. This is a conflict between production needs and safety. An example of this is decisions made about staffing levels.
OC	Culture	Failures resulting from collective approach and its attendant modes of behavior to risks in the investigating organization.
Active Errors		Errors or failures resulting from human behavior
Human		
HEX	External	Human failures originating beyond the control and responsibility of the investigation organization. This could apply to individuals in another department.
Knowledge-based Behaviors		
HKK	Knowledge-based errors	The inability of an individual to apply their existing knowledge to a novel situation. Example: a trained blood bank technologist who is unable to solve a complex antibody identification problem.
Rule-based Behaviors		
HRQ	Qualiifications	The incorrect fit between an individual's qualification, training or education and a particular task. Example: expecting a technician to solve the same type of difficult problems as a technologist.
HRC	Coordination	A lack of task coordination within a health cares team in an organization. Example: an essential task not being performed because everyone thought that someone else had completed the task.
HRV	Verification	The correct and complete assessment of a situation including related conditions of the patient and materials to be used before starting the intervention. Example: failure to correctly identify a patient by checking the wristband.
HRI	Intervention	Failures that result from faulty task planning and execution. Example: selecting the wrong protocol (planning), carrying it out incorrectly (execution). Example: washing red cells by the same protocol as platelets.
HRM	Monitoring	Monitoring a process or patient status. Example: a trained technologist operating an automated instrument and not realizing that a pipette that dispenses reagents is clogged.
Skill-based Behaviors		
HSS	Slips	Failures in performance of highly developed skills. Example: a technologist adding drops of reagent to a row of test tubes and then missing the tube or a computer entry error.
HST	Tripping	Failures in whole body movements. These errors are often referred to as "slipping, tripping, or falling." Examples: a blood bag slipping out of one's hands and breaking or tripping over a loose tile on the floor.
Other Factors		
PRF	Patient-related Factor	Failures related to patient characteristics or conditions, which are beyond the control of staff and influence treatment.
X	Unclassifiable	Failures that cannot be classified in any other category

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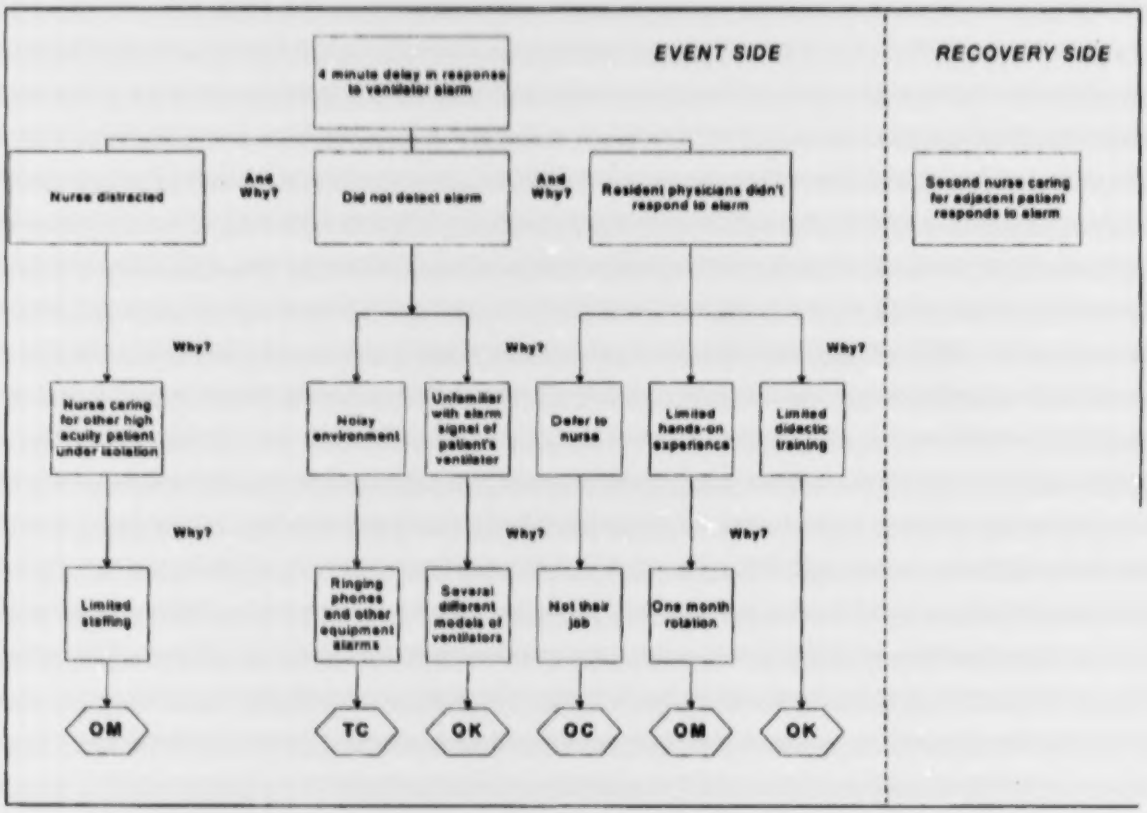

Figure 1 Causal Analysis of Delayed Response to Ventilator Alarm

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before they result in an adverse outcome. To do this requires a focus not only on adverse events, but also on the capture, recording, and analysis of near miss events as well. Without an adequate understanding of the causes of error or near miss events, there is little likelihood that the error can be prevented in the future. Organizations should seek to learn from every event. In order to capture near miss events it is necessary to create a safety culture in which every one in an organization will report conditions and actions with the potential to diminish patient safety. It is likewise necessary to stop looking to assign blame when an error is identified (except in the rare case of reckless behavior), but rather look to the root causes of the error. To sustain a safety reporting system, it is of special importance to provide staff with feedback on event analysis and process improvements that are a result of their efforts in error management.

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Preventing Patient Injuries

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Preventing Patient Injuries

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A full year has not yet elapsed since the Institute of Medicine's Committee on Quality of Health Care in America released their report on patient injuries in American health care.[1] Others in this conference have reviewed the report's recommendations and the useful academic debate that the report produced.[2-5] While some argued about the real number of preventable deaths and injuries that Americans suffer when they seek health care services, all agreed that the American health care system should take immediate action to reduce those numbers. My purpose in this report is to identify possible next steps in that journey. To that end, I will review an improvement project led by Dr. Scott Evans at LDS Hospital,[6-8] then attempt to draw general conclusions gained from that and other similar experiences as guideposts for future work.

Detecting Adverse Drug Events

Adverse drug events (ADEs) — most frequently, drug overdoses or allergic reactions — are the most common iatrogenic injury that patients face in American hospitals.[9,10] Most hospitals track ADEs through incident reports: When a drug event occurs, the patient's nurse is charged to complete a form that lists the nature of the reaction, its probable causes, steps that were taken to correct the error, and the names of clinicians involved.

In 1988 Evans *et al.* questioned whether nurses at LDS Hospital (a 520-bed private, tertiary, teaching and research hospital based in Salt Lake City, Utah) were accurately reporting all ADEs that occurred in the facility.[6,7] The study team hypothesized two factors that could lead floor nurses to appropriately manage an ADE but not document it with an incident report: (1) Nurses are very busy meeting patient care responsibilities. Extra paperwork is never a welcome task. (2) By filing an incident report, nurses possibly identify themselves as a quality outliers and open themselves to criticism and blame. The ensuing investigation, even if it exonerates the clinicians involved, can be emotionally draining and professionally damaging.

The team therefore constructed three parallel systems to simultaneously track ADEs at LDS Hospital:

1. Hospital administration continued to demand standard incident reports — "nurse incident reporting" — where the patient's senior nurse completed and submitted a one-page form.

2. Evans observed that when a floor nurse did submit an ADE incident report, hospital administration sent a nurse researcher to confirm and re-abstract all information contained on the form. That made the floor nurse's original work entirely redundant. Under "enhanced reporting" the floor nurse needed only flag a patient's chart as containing a possible ADE. The investigating nurse researcher completed all necessary paperwork. This approach removed the data burden otherwise associated with reporting ADEs.

3. LDS Hospital employs a computerized medical record.[11-13] It encodes about 85 per cent of all patient information, including demographic factors (admit/discharge data); all laboratory reports (such as clinical laboratory results, imaging examination results, pathological reports, microbiology results, etc.); all order entry; all nursing information (e.g., nursing history and physical examinations, nursing care plans, discharge plans, all medication sheets, daily nursing progress notes, etc.); and each patient's admitting history and physical examination as prepared by the attending physician. The only major part of the medical record that is not available

through the computer system is physician daily progress notes.

Evans prepared a computer program to detect clinical responses that might flag an associated ADE. For example, the program captured any use of an antidote drug, such as a dose of naloxone to counteract an opiate. It detected sudden, unexpected changes in drug orders. It flagged laboratory test orders that might be associated with an ADE. It examined nursing progress notes, searching for diarrhea or rashes.

The team ran all three detection methods in parallel for 18 months. A pharmacist investigated every potential ADE detected by any of the three systems, to determine whether an ADE had actually occurred. The pharmacist also used standard definitions to categorize each confirmed ADE: (1) A *mild* reaction required only cessation or adjustment of the offending drug, followed by observation. (2) A *moderate* ADE required active therapy, such as antidote drugs, additional days in the hospital, or special nursing services, but did not threaten the patient's life or long-term function. (3) A *severe* ADE was potentially or actually fatal, requiring immediate, vigorous intervention, or it caused significant long-term morbidity.

Table 1 shows the number of confirmed ADEs detected by each system. At the time most American tertiary teaching hospitals reported ADE rates similar to those found at LDS Hospital through its standard nurse incident reporting system. The computer-based detection method discovered that the hospital's true ADE rate was more than 80 times higher than that well-accepted, and expected, historical rate. Classen carefully measured the marginal cost (not charge) to treat moderate and severe ADEs at LDS Hospital. On average, each such event increased patient care costs by more than 2400 dollars.[14]

Various groups have employed four main methods to track ADE rates within hospitals:

1. Voluntary nurse incidence reporting usually underdetects true events by 1 to 2 orders of magnitude, as illustrated in the foregoing example. Still, it is the method employed within almost all American hospitals to track this important class of injuries.

Some groups (e.g., Veterans Administration hospitals) report significantly better voluntary reporting of patient injuries than that demonstrated by other American hospitals.[15,16] Such systems rely heavily upon a "culture of safety," that actively encourages health professionals to quickly report patient injuries and near misses. Those events are recorded and analyzed, leading to system changes that "make it easy to do it right, make it hard to do it wrong."[1] A culture of safety stands in stark contrast to America's traditional health care culture. That approach concentrates on errors, apparently under the belief that human beings – including health care professionals – are perfectable: When an injury occurs, it arises from a personal failing of the individuals involved. Those clinical traditions, reinforced by medical malpractice and political attempts to find and eliminate bad apples,[17] fly in the face of research demonstrating that all humans are inherently fallible,[18] regardless of inherent ability, training, or personal effort.

2. Retrospective chart review examines medical records well after any opportunity to intervene during an event has passed. Moreover, many ADEs may never appear in a medical record in an understandable way. For example, the EPIC study used retrospective chart review to track adverse events, including ADEs, at hospitals in Utah and Colorado.[19] That system failed to detect more than 30 percent of confirmed events found through the computerized system using clinical response triggers. Conversely, the clinical response triggers missed less than 2 percent found by retrospective chart review.[20]

3. Clinical response triggers identify easily detected orders or events that might represent clinicians' reactions to adverse events. Experience to date suggests that such systems are quite sensitive to moderate and severe adverse drug events, they are not particularly specific. Only about one in five of all potential ADEs identified in a typical clinical response detection system turned out, upon expert review, to be actual adverse events. Clinical response detection systems also miss almost all mild ADEs, which by definition do not require a clinical response

Adverse Drug Event (ADE) Detection Using Three Concurrent Systems			
# of ADEs/% (# per annum)	Nurse Incident Reporting	"Enhanced Reporting"	Computerized detection
Total ADEs	9/0.25% (6)	91/0.25% (60)	731/2.0% (487)
Moderate/Severe ADEs	—	—	701/1.9% (467)

Table 1. Adverse drug events (ADEs) at LDS Hospital over 18 months (May 1, 1989, to October 31, 1990) and per annum, covering 36,653 hospitalizations, as discovered by three different detection systems.

and so generate no reactions that could trigger the detection system.

4. Daily pharmacist review of all patients provides the most sensitive method to detect adverse drug events. Such also inherently implements real-time response – the pharmacist coordinate changes to orders and treatment for developing injuries immediately. They are, however, very expensive to operate. Research projects at Brigham and Womens Hospital in Boston by Dr. David Bates[21], a hospital in Israel, and a major teaching hospital in Zurich, Switzerland (ref: Dr. Samuel Henz, Kantonsspital St. Galen, samuel.henz@kssg.ch), have illustrated their strengths and weaknesses.

While Evans used an electronic medical record to implement the ADE clinical response trigger system used at LDS Hospital, it is possible to closely match that performance using only manual methods. Table 2 lists 14 of more than 50 clinical response triggers included in the computerized system, that accounted for almost 96 percent of all confirmed ADEs detected. Those 14 triggers focus within only three care delivery locations: The pharmacy (10 triggers), the clinical laboratory (3 triggers), and nursing notes (1 trigger).

A hospital that does not use electronic medical records – in other words, almost any hospital in the United States – could reasonably ask health professionals working in the pharmacy and laboratory to log all patient orders the represent a trigger found in the list. Once a day, a pharmacist could collect the lists then review each case so identified, using standard definitions to confirm and classify most true ADEs occurring within the facility. Note that computerized detection requires the same human-based, professional review and classification. At LDS Hospital – again, a 520 bed tertiary facility – that effort consumed about 30 percent effort for an experienced pharmacist trained in its use.

Preventing Adverse Drug Events

With a more accurate measure of the hospital's true ADE rate in hand, Dr. Evans called together a team of individuals expert in ADE prevention and

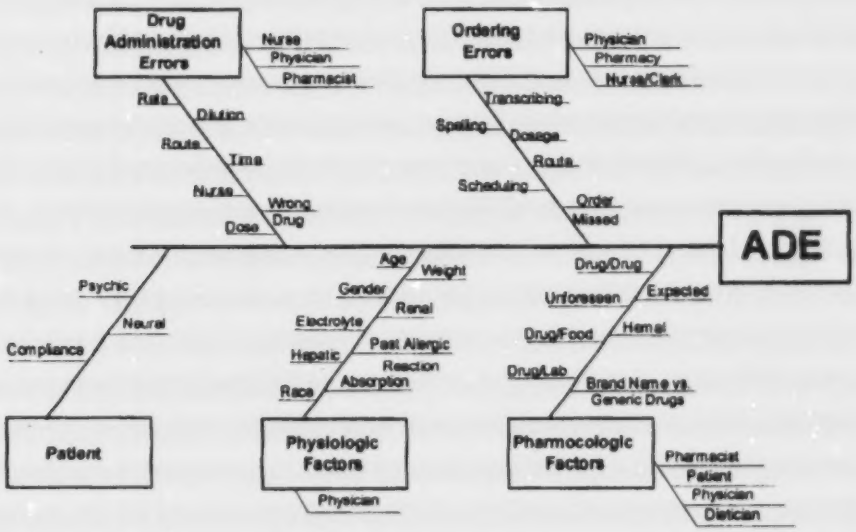

Figure 1. Cause and effect diagram for adverse drug events. A group of knowledgeable clinicians produced a list of 32 possible ADE causes, classified into 5 subcategories.

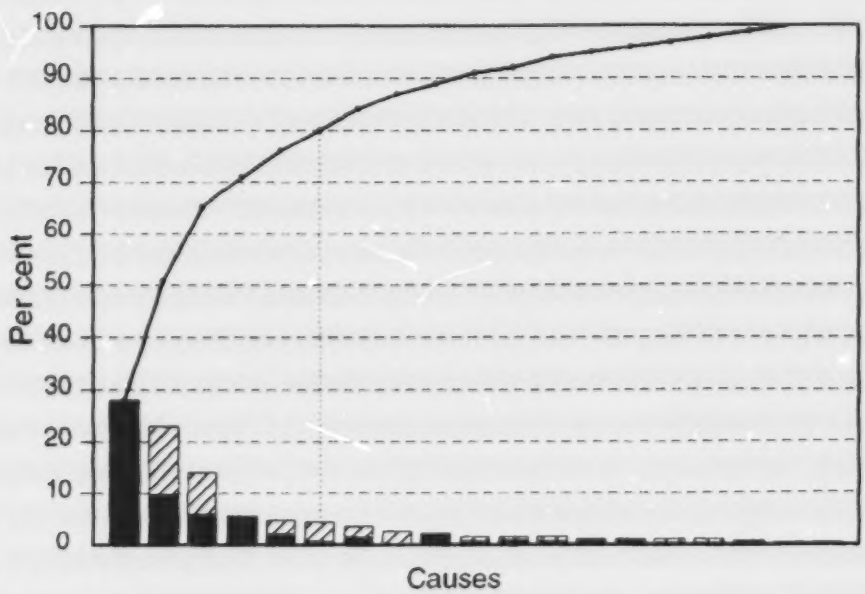

Figure 2: . Actual causes of adverse drug events at LDS Hospital, in order of frequency. The top 6 categories accounted for 80 percent of all ADEs detected (see Table 3).

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Clinical Response Triggers for Identifying Potential Adverse Drug Events				
ADE Alert	Location	True Positive Rate (%)	% of all ADEs Detected	Cumulative % Detected
1. Use of naloxone	pharmacy	21.9	28.3	28.3
2. Use of benadryl	pharnacy	21.0	20.8	49.1
3. Use of inapsine	pharmacy	39.2	20.4	69.5
4. Use of lomotil	pharmacy	26.8	8.5	77.0
5. Nurse reports of rash/itching	nurse reporting	17.9	5.1	82.1
6. Use of loperamide	pharmacy	22.3	3.4	85.5
7. Test for *C. dificile* toxin	Clinical lab	24.3	3.1	88.6
8. Digoxin level > 2	Clinicl lab	2.3	2.2	90.8
9. Abrupt med stop or reduction	pharmacy	48.0	1.0	91.8
10. Use of vitamin K	pharmacy	4.8	0.9	92.7
11. Doubling of blood creatine	Clinical lab	0.4	0.8	93.5
12. Use of kaopectate	pharmacy	21.8	0.7	94.2
13. Use of paregoric	pharmacy	9.8	0.7	95.0
14. Use of flumazenil	pharmacy	77.3	0.7	95.7

Table 2. Dr. Samuel Henz, while on sabbatical at the IHC Institute for Health Care Delivery Research, reviewed 34,900 ADE alerts generated over 9 years of prospective ADE detection at LDS Hospital. Among more than 50 detection criteria used in the computerized system, just 14 criteria accounted for almost 96 percent of all ADEs successfully detected.

Major Causes of ADEs			
Class	%	Description	Preventable?
Pharm expected	28.0	Allergic reactions in patients without a known histroy of allergy to a particular agent	?
Physio renal	23.0	Failure to adjust dosage for decreased renal function, resulting in *de facto* overdose	Yes
Physio age	14.2	Failure to adjust dosage for patient age, resulting in *de facto* overdose	Yes
Physio weight	5.7	Failure to adjust dosage for patient body mass, resulting in *de facto* overdose	Yes
Order dosage	5.0	Error in dosage on order sheet	Yes
Pharm Hemal	4.6	Failure to adjust dosage for known hematologic factors	Yes
Patrient compliance	3.8	Patient non-compliance	?
Admin rate	2.7	Error in drug delivery rate	Yes
Physio hepatic	2.3	Failure to adjust dosage for decreased liver function, resulting in *de facto* overdose	Yes
Physio allergic	1.5	Failure to recognize known patient drug allergies	Yes
Physio electrolye	1.5	Failure to adjust dosage for known electrolyte imbalances	Yes
Order schedule	1.5	Error in dosage timing on order	?
Total preventable	65.8		

Table 3. High-order causes of adverse drug events detected at LDS Hospital. A cause was marked "preventable" if the clinical team could devise a plausible scheme that, if implemented, they judged should significantly reduce the number of ADEs arising from that cause. When preventable ADEs are summed across all categories (as opposed to just those shown in this table), they total 66.2 per cent of all ADEs that occurred at LDS Hospital during the study period. Note that idiosyncratic / allergic reactions – the largest single category of ADEs – were not judged to be preventable, and so are not included in that total.

treatment. In a one-hour meeting the team generated a list of more than 30 preventable causes of ADEs. They organized their list using a cause and effect diagram, a common quality improvement tool (Figure 1). A nurse researcher then used the cause and effect diagram as a tally sheet (a second simple quality improvement problem-solving tool) to classify each ADE based on the list of hypothesized possible causes. The team displayed the resulting categorized ADE counts as a Pareto chart (Figure 2), a third simple quality improvement tool. Among more than 30 potential causes of ADEs, six accounted for 80 per cent of all ADEs occurring at LDS Hospital. Table 3 lists the first 12 items from the Pareto chart in tabular format.

Finally, the team used the prioritized list to plan and test a series of interventions. For example, a member of the team programmed the clinical information system to calculate kidney function based on creatinine clearance rates. The program estimated creatinine clearance using a patient's body surface area (available through standard nomograms based on a patient's height and weight) and blood creatinine levels (readily available in the computerized record for nearly all patients as part of a routine blood chemistry panel). The program linked that calculation to any pharmacy order that involved a drug excreted through the kidneys. Each time any renally-excreted drug was scheduled for delivery to a patient, the computer automatically estimated peak blood levels based on estimated creatinine clearance and a series of pharmacokinetic models. If the resulting peak blood level was either above or below the drug's appropriate therapeutic range — whether due to a mistake in ordering or undetected declines in renal function — the computer automatically alerted the hospital staff. It total, the program also considered known drug allergies, other agents the patient may have been receiving (drug-drug interactions), other blood chemistry levels, the patient's age, gender, body mass, estimated liver function (as appropriate), and other pertinent patient factors.

As a result of the interventions developed and implemented by the ADE team the adverse drug event rate at LDS Hospital fell by more than 30 per cent.[22] Table 4 shows rates of allergic / idiosyncratic reactions (Type B ADEs) and Severe ADEs

Effect of Clinical Decision Support on ADE Rates

# of ADEs/% (# per annum)	Nurse Incident Reporting	"Enhanced Reporting"	Computerized Decision
Type B ADEs	58	8	18 (p>0.002)
(Patient days)	(120,213)	(113,237)	(a07,868
Severe ADEs	41	12	15 (p<0.001)
(Patient Days)	(113,859)	(103,071)	(108,320)

Table 4. Idiosyncratic / allergic (Type B) and Severe adverse drug event rates associated with antibiotic therapy before and after implementation of a clinical decision support system for antibiotic drug ordering and delivery.[23]

Common Sources of Patient Injuries
1. Medication ordering and delivery (adverse drug events)
2. Prevention and treatment of nosocomial infections: a. Post-operative deep wound infections b. Urinary tract infections c. Lower respiratory infections d. Bacteremias and septicemias
3. Prevention and treatment of deep venous thrombosis / pulmonary embolism
4. Prevention and treatment of decubitus ulcers
5. Strength agility, and cognition (patient falls and injuries; use of physical or chemical restraints)
6. Blood product transfusion

Table 5. Frequent sources of patient injuries, based on measured rates and clinical judgments of severity of injury within the Intermountain Health Care integrated delivery system (22 hospitals and more than 100 clinics in Utah, Idaho, Wyoming, and Nevada).

associated with antibiotic usage at the hospital following implementation of the ordering system.[23] In addition to significantly better clinical outcomes, LDS Hospital's fall in ADE rates also represented a significant cost saving, as the hospital avoided the costs of treating the events.

Lessons Learned

Some sources of patient injuries are not uncommon. The IOM error report drew heavily on event detection and reporting systems developed and proven for safe air travel by the National Transportation Safety Board and the National Aeronautics and Space Administration (NTSB / NASA). Kizer used the NTSB / NASA approach to attack patient injuries within the Veterans Administration Hospital system.[15,16] That technique relies upon identification of events or near misses, careful root cause analysis, storage of de-identified events in a data system, then analysis looking for patterns of preventable errors. While root cause analysis works well for rare events, ADEs are anything but uncommon. Table 5 lists an ordered series of classes of common patient injuries, generated within the integrated health care system that LDS Hospital anchors. An examination of frequent causes of patient injuries found in Australian hospitals generated a similar list.[24-26] Rather than relying on root cause analysis and reporting, it may be more effective to directly, explicitly track common sources of patient injuries for immediate action to prevent future events, saving root cause analysis for truly rare events (including follow-on analysis for rare causes of otherwise common injuries such as ADEs, after established techniques have been applied and the initial injury rate significantly reduced).

Even common types of patient injuries are not created equal. Some are far more common than others. Health care professionals may need to prioritize areas of attack, in order to achieve the greatest reduction in patient injuries in the face of limited time and resources. While Table 5 seems to match expert opinion fairly well, careful research documenting an objective prioritization at a national level is not yet available.

The health professions already have a great deal of experience, including proven solutions, for many types of common injuries. Health professionals can draw on broad experience describing proven methods for preventing many of types of common patient injuries. For example, the Institute for Healthcare Improvement's Break Through Series on Adverse Drug Events[27] contain an impressive list of interventions that worked in at least some institutions. Similarly, Blumenthal is preparing a list of proven interventions drawn from other non-medical fields, the medical literature and trusted experience.[28]

The core problem may be better termed "patient injuries" than "errors." In the LDS Hospital experience, Type B ADEs – allergic and idiosyncratic reactions – represented 28 percent of all ADEs and the single largest class of ADE patient injuries (Table 3). In those cases, clinicians discovered a patient's previously unknown allergy by giving the drug. When initially examining their data, the ADE clinical team judged that such events did not represent care delivery errors and that they were not preventable. But Evans was able to program the clinical decision support system to offer safer alternatives when a physician ordered a drug with high allergenic potential, and thus was able to significantly reduce Type B ADEs. No one thought to classify Type B ADEs as ordering errors until after experience revealed a path by which they could be addressed.

The term "errors" contains often unconsidered judgments about cause and preventability that can limit clinicians' response. Reliance upon the term may unnecessarily delay clinical solutions through the mind set that the term creates. Many sources of injury that health professionals initially judge to be unavoidable, on closer examination, may turn out to be highly susceptible to intervention. Even when clinical experience does not provide current answers, a broader focus that includes all patient injuries can lead to focused research and future answers.

In writing their report, the IOM Committee on Quality of Healthcare in America understood "errors" in a system sense. Even when discussing clearly human errors – a subset of all errors that the Committee identified – the report argues for system solutions. While use of the term errors served a very useful political purpose upon the report's initial release, to concentrate popular and professional attention to solve an important problem, the need for such pejorative language has passed. Caring

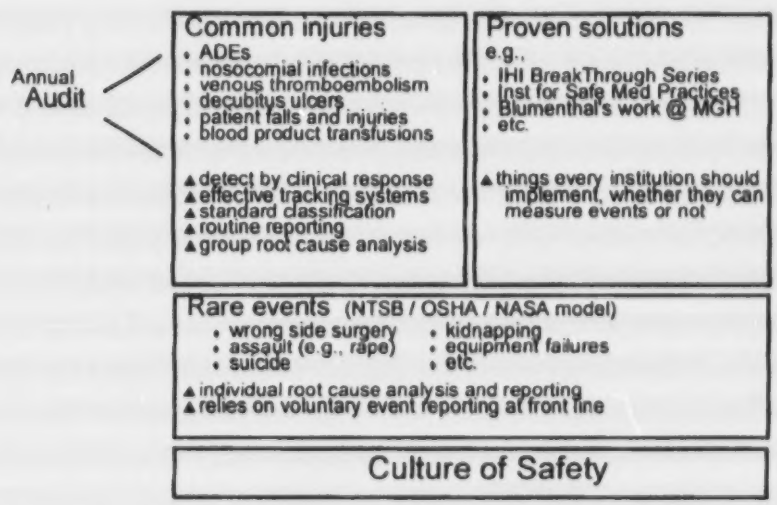

Figure 3: Patient Safety System

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professionals should identify and work to eliminate all patient injuries associated with health care delivery, now and in the future.

Summary

Figure 3 attempts to provide a simple schematic of a patient safety system that health care delivery organizations, health care purchasers, and health care regulators might use to reduce injury rates. The entire structure rests upon a new culture of safety. That represents a major shift in thinking for all involved groups, but it does not represent a new model. NTSB, NASA, OSHA, or other groups have clearly demonstrated that a culture of safety is essential if the aim is to prevent injury, rather than punish health professionals for errors that we know those professionals cannot avoid. Root cause analysis is reserved for true rare events. All health care delivery systems implement proven methods, even if they cannot immediately, accurately measures the rate of occurrence of those events within their walls. Finally, the schematic calls for accurate measurement and reporting, with audit, of common sources of injury.

I leave you with some questions: How should the American health care system think about patient injuries? Is it best to think in terms of injuries, rather than errors? Should we separate common injuries from rare events, in terms of tracking and response systems? A common ethic of the medical profession says "First, do no harm." How can we best make that real for every patient, every day, across the entire health care delivery system?

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Collaborative Education to Improve Public Safety

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Collaborative Education to Improve Public Safety

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Part One

Every system is perfectly designed to achieve the results that it yields

The public's dis-ease with the safety of health care interventions today is prompting inevitable, systemic changes in the way health care is practiced and health care professionals are educated. (Lorenzi and Riley 2000) We know that, when doctors and nurses work together in a collegial environment of mutual trust and respect, errors decline, patient outcomes improve and provider satisfaction increases. We also know that this environment is the exception rather than the rule, and that we do not do a good job of educating health professionals to either create or sustain such environments.

Because of the Institute of Medicine's report on medical errors, (Kohn, Corrigan, and Donaldson 2000) To Err is Human, (or perhaps in spite of it), current models of health care education are ripe for revolution. Revolution occurs when desperation exists. The usual ways of "fixing" must have failed and, second, villains such as organizations and systems whose steady response is "no" and whose actions are devoted to defending that 'no' must be easily identifiable. Their platform must suggest that the status quo should be maintained, privileges should be kept for those who already have them and chaos will result if power or control is diminished. (I do not want to be indelicate, but the recent uproar between anesthesiologists and CRNAs over Medicare reimbursement to CRNAs and the recent "Citizens Petition" sent to the Health Care Financing Agency by the American Medical Association reinforces to nurses that this platform is alive and well.) It is also fair to say that organized nursing is far from blameless over ownership issues of power and control. Finally, a revolution needs a theoretical basis supporting manifestos and visions. On all three counts, health professionals' education and practice is ripe for revolution and theories from business and the corporate world are beginning to penetrate theories of education and practice.

Andrew Grove (1996), in his book, Only the Paranoid Survive, theorizes about the impact of strategic inflection points or SIPs on change. SIPs are "second order change"; they are fundamental power shifts in the way things operate; they are subtle and discernable only in retrospect and force the principals to act before clarity emerges. Some examples of SIPs are silent movies to talking movies, Mom and Pop shops to Home Depot and Wal-Mart and Ma Bell to Baby Bells. The IOM report, To Err is Human, (Kohn, et al. 2000) may well serve as the Year 2000 SIP for healthcare education and practice, with the impact of the Flexner Report on Medicine (1910) and the Goldmark Report on Nursing (1923).

Educational silos, the physicians' "captain of the ship position" and the identification of nurses as "non-physician providers" (nurses do not refer to physicians as "non-nurse providers"), are no longer supportable in our interdependent world and in our need to educate in an interdisciplinary fashion in spite of the obvious barriers. Examples of these barriers are the guilds (the American Medical Association, the American Nurses Association and other, companion professional organizations), cross–subsidies (Graduate Medical Education funds are not based on the number of physicians projected to be needed, are not consistent in payment, and ignore the need for nurses educated beyond the diploma level), and the assumption that teaching involves passing knowledge directly to the student at a certain time and place with a teacher as a sage on the stage rather than a guide on the side! To further complicate things, we are attempting to and, in fact, are being forced by the public's dis-ease to frame a response to this strategic inflection point before clarity emerges! How can we capture the power shift of the "second order change" of the IOM report? (Kohn, et al. 2000)

First order change is a "variation and improvement in the way processes and procedures have been done in a given system, leaving the system itself relatively unchanged." (Lorenzi and Riley 2000) As educators, we know that first order change in the areas of cognition, behavior and attitudes is difficult but

possible. For example, we have been forced by economic realities to look at how we can improve our current curricula processes, and this has resulted in more somewhat cost effective (but still discipline-specific) curricula, evidence-based guidelines, protocols, and some asynchronous learning efforts, etc., as we focus on change in the cognitive area. The need for negotiation skills has influenced efforts to teach the mechanics of behavioral change (and yet few faculty have the negotiating skills of a neophyte union mediator), and increased internet access is forcing health professionals to recognize even more fully patients and families are partners. Competency in these three areas is the minimal requirement for a successful career and we have had some limited success in interdisciplinary practice and education in these areas.

However, we are also going to need to become skilled in teaching **second order change** (which occurs when the system itself is changed; the core business is re-defined or re-conceptualized; and the way the core business is conducted in the areas of technology, organizational adeptness and communication drastically alters. (Lorenzi and Riley 2000) These are the competencies required for superior performance and reduction of variation (a key cause of medical errors) and we have had very minimal success in interdisciplinary practice and education in these areas. Yet, technology has freed us from space and time constraints via the internet; and we are inevitably recognizing (as are our accreditation bodies such as the National League for Nursing (NLN), the Commission on Collegiate Nursing Education (CCNE), the Liaison Committee on Medical Education (LCME), and the Accreditation Council of Graduate Medical Education (ACGME)), that our graduates must be taught the tools of continuous process improvement (cpi) so that they can assess and modify systems quickly regardless of space and time. From an organizational perspective, the post-Genomic era will customize individual and ethnic prevention and treatment, put the patient/consumer in control, and change the very nature of how we view intervention and disease. Finally, communication skills must be better taught so that students can learn how to fit into a series of ever-changing systems (for example, being able to rapidly deploy the therapeutic relationship via e-mail) seamlessly.

Meanwhile, the system itself is in the midst of what Dee Hock (1999) would envision as "chaordic change"; the system is functioning in the zone between chaos and order while, at the same time, a new order of relationships among providers, payors and patients is emerging. In fact, patients and consumers, as a result of second order change, are ascending to a new level of control in the health care delivery system. Chaordic organizations are distinguished by being owned by all participants — with power and function distributed to the maximum degree. The two pure chaordic organizations in the world today are the Internet and the credit card networks. To survive, health care delivery and education must be re-conceptualized in an interdisciplinary, chaordic manner so that no individual or institution dominates deliberations or controls decisions to the detriment of the system. Healthcare delivery and education must be malleable, durable and able to embrace diversity. Distributed power and function and a just-in-time educated work force are critical to success. "If we can envision a way to make things significantly better for the consumer and to efficiently provide a more effective work force, we should be able to work out a transition plan for re-reinventing the guilds and dismantling the cross-subsidies." (Stead 1998)

Faculty and curriculum must be approached differently. Faculty will be assisted by computer support specialists consisting of systems analysts, instructional designers and graphic designers, with access to the best units or modules on a particular topic through inter-institutional/global educational networks, resulting in greatly reduced variation. We must question how many faculty (fewer and of higher quality) we need to run an educational program and how many (more) technicians we need to support that faculty. Students will memorize fewer facts in favor of just-in-time learning. Their world will be asynchronous and they will receive information wirelessly. Our grandchildren will look back on the personal computer as a quaint artifact, as common tomorrow as a covered wagon is today. Eventually, everything electric will communicate with all other electronics wirelessly.

The ability to perceive and work in interdependencies will be critical to survival in a chaordic world. Finally, this chaordic future will trigger disintermediation

where the Internet will allow consumers to go outside of systems to meet their needs. If our educational and practice systems do not meet our students' and client needs, they — as well as their employers — will by-pass them as well.

The former CEO of Oxford Health Care has launched a new company — Healthmarket.com — a web-based purchasing company. Consumers, operating through corporate buying groups, can be aggregated onto regional business sites to purchase services directly from groups of providers and agencies/institutions and can negotiate on the basis of price, credentials and quality ratings. They will be able to shop for the best price for a gall bladder procedure (á là priceline.com). The Healthmarket will also offer its own health plan, which will enable customers to select from different premium options and choose different providers or provider organizations for treatment, based on their cost, experience and published outcomes. By enabling consumers to take control of their personal health needs through these web-based services, Healthmarket expects to be 5% to 15% less expensive than the equivalent managed care plan. Employer-directed insurance is ending; employees will receive a lump sum for benefits (called a "defined contribution") and will shop the internet for the best benefits offers that fit their particular needs. Changing our healthcare educational and practice systems to an interdisciplinary focus will revolve around an interdependent and disintermediated distribution of power and money where informed consumers will view practice profiles and provider outcomes on the internet before making provider selection decisions.

How will this affect health professional education and practice? Nurse practitioners, supported by practice guidelines and computerized data on treatment protocols, could be selected by consumers as their first point of entry into the health care systems. (Institute, 2000) Employers, left to their own devices, could design and implement for-profit colleges and training programs if organized medicine, nursing, and allied health care are too slow in response to their needs because of our absurd variations in practice and education, our self-serving, discipline-specific "silo" mentality, and our inability to see, teach and practice health care in interdependent systems.

Part Two: RECOMMENDATIONS

So, what are the levers and pulleys that must be in place to foster collaborative practices that reduce variation and errors, increase productivity, and increase the satisfaction of providers, payors, and consumers? Ideally, seeing the wolf at the door, MD/RN faculty will work together to state desired outcomes and then work backwards to re-frame the theoretical and clinical requirements of our three missions of teaching, practice and research into a collaborative, interdisciplinary model. However, given the daily stress that characterizes our healthcare delivery and educational systems, the likelihood of this happening without major, second order change, is unlikely — at least in a timely manner – without some major incentives.

Question #1: How can two separate and distinct educational systems prepare faculty to work and teach in a collaborative systems environment?

Recommendation #1: They cannot!

Question #2: What are the recommendations for preparing faculty to work and teach collaboratively in a systems environment?

Recommendation #2: Create an organization in which are all incentivized to participate to advance their own self-interest and one whose clear and major purpose is the re-structuring of health professions' education and practice into interdisciplinary efforts. Organized nursing does not have this vehicle. Occasional attempts, such as the Kellogg Foundation-funded National Commission on Nursing Implementation Project (NCNIP) — in the 1980's — attempted to put some structure in place to encourage the major nursing organizations to meet quarterly to attempt to achieve consensus on policy-related issues regarding education and practice. NCNIP included the Tri-Council (composed of four nursing organizations, ANA, NLN, AONE and AACN) along with several other influential "players," such as the National Council of State Boards of Nursing (NCSBN), and attempted to knit together a cohesive group which could achieve consensus — to little avail. Therefore, create an ASO — an

administrative services organization — with a combination of private/public funding (perhaps some Title VIII and VII monies plus new federal funding which will occur as a response to the nursing shortage plus relationship with other agencies such as AHRQ - the Agency for Healthcare Research and Quality) and corporate/foundation funding (see attached Leapfrog group) with membership from schools of medicine, nursing, and allied health, academic health science centers (Levinson and Rubenstein 1999) and representation from HCFA, commercial insurance companies, labor economists and health economists, to evaluate and fund projects or "collaboratories." (I would suggest that many foundations are frustrated with trying to move health professionals' education and practice to an interdisciplinary concept!) And might welcome such a partnership. This ASO should:

2.1. Require that funded "collaboratory" projects have measurable outcomes and an acceptable cost-benefit ratio. And that reimbursement problems and licensure issues that prevent the full utilization of any provider are documented and addressed.

2.2. Require the collaboratories to allow all providers to practice to the full scope allowed by law.

2.3. Analyze the economics of the incredible waste and re-work inherent in our education systems. Direct special attention to our nursing education system and all the different paths one can take to become a nurse. Nursing has proven incapable of solving this problem alone and, in fact, it is too important to leave to nursing alone as is partially evidenced by the impending nursing shortage. If no action is taken to streamline nursing education, consumers and employers will take advantage of disintermediation. Using information systems and web-based courses, they will by-pass traditional schools of nursing and add to the growing number of corporate universities and certification courses.

2.4. Make the business of health care a significant focus in our interdisciplinary curricula. Finance is a neutral area that all health professionals need to know. Create a core curriculum and award joint, collaborative grants to schools of medicine, nursing, and allied health (not necessarily in the same university) to jointly reconfigure their curricula to offer such interdisciplinary courses to diverse groups of students.

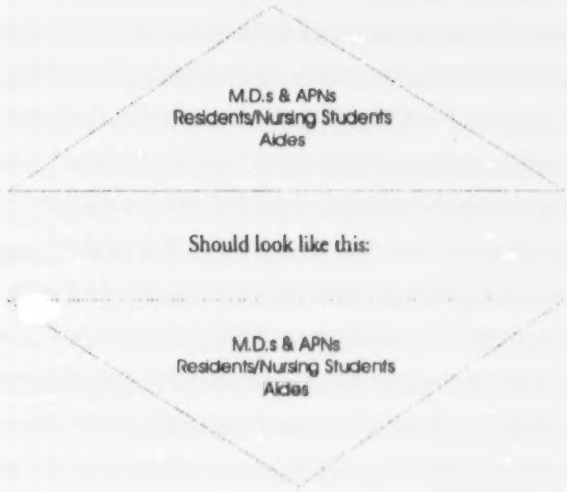
2.5. Encourage additional changes in JCAHO accreditation as well as additional accreditation/certification from major medicine, nursing, and allied health groups that would require documentation of interdisciplinary educational and practice efforts which are linked to process improvement tools and techniques. Require them to show that they have had a measurable effect (positive or negative) on patient and student outcomes.

2.6. Explore the utilization of "micro-systems" as a curriculum concept. All care (and teaching/learning) is requested, created, delivered, changed and evaluated within micro-systems. Both MD/RN educators and practitioners do "the overwhelming amount of their own daily work as part of a small group (micro-system) of people and technology. Baltalden and Nelson (1999) suggest that a micro-system is comprised of providers, support personnel (including administrative, clerical and minimum wage folks), information technology, a defined group of patients, and an aim which is framed by the general purpose of the interaction. Baltalden (1999) suggests that if the integrity of that "micro-system" is impaired, the loss of functionality and increase in cost is significant. The caretakers (micro-system) of a group of patients (however defined) interact with those patients and each other not solely as individuals but as members of a micro-system (which can also be conceptualized as a "pod", a panel of patients, a clinic, etc.).

Yet, individuals are steadfastly encouraged to "de-contextualize" themselves from the "micro-system" for purposes of incentives, educational interests, benefits, rewards, raises, (Baltalden 1999) and (dare I say) tenure. In addition, public health has been dissected from the health care delivery and education system, and created as a separate discipline (as has health administration). Yet, all are part of the larger system which can interfere with the "micro-system" by recognizing the unit of analysis as the individual rather than the micro-system (team) and holding the individual, rather than the micro-system, accountable. The "micro-system" environment, with system accountability and mutual responsibility, is probably the only work environment where medical mistakes

(which occur mainly due to system failure) can be avoided, dodged or treated as learning experiences.

Therefore, charge the ASO to review and fund MD/RN/Allied Health demonstration "collaboratories" that re-design education and practice delivery systems — and encourage liberal testing of a variety of models (including the micro-system) where collaboration is created and rewarded and where the team or group is held accountable for patient (or student) MD/RN and MD/APN (advanced practice nurse) outcomes. Start with the premise that the current triangle of



There is money in the system to pay highly skilled knowledge workers if technology is used to thoughtfully decrease the number of lesser-trained personnel (who will be difficult to attract to health care jobs in the future anyway!)

2.7. Use the healthcare financial crisis, the over-bedded hospital crisis, and the inability to determine, on a national level, the numbers and types of physicians, nurses, and advanced practice nurses needed to create a "burning bridge" to draw attention from both the public and private sector. We have an economically unsustainable model of resident and advanced practice nurse (APN) education. Strangely, resident training relies on GME dollars while APNs must pay for their own education. Neither educational pathway (very isolated from one another) is based on workforce-projected needs — each remains a cottage industry — relying heavily on the maintenance of turf and self-interest strategies and tactics. (Cooper, Land, and Dietrich 1998)

Bill Stead's (1998) Vision for 2008 sees students entering the health professions through a single learning pathway and then differentiating, depending on the services they wish to provide — and the length of time they wish to study — with learning and employment closely coupled from the start. In this manner, habits will be formed to support life-long learning in the workplace. The sequence is detailed in Stead's (1998) paper, but it utilizes need-based, adaptive, competency-based learning with an entry phase after high school of six months to two years, a basic practica of six months to two years, and an advanced experience in a research or clinical track of 2-5 years. This "vision requires a robust information technology infrastructure and advances through informatics research to support privacy, intuitive human interfaces, connectivity, data aggregation and simulation or modeling." The process of continuous improvement should be the cornerstone of this collaborative curriculum so that the graduates, regardless of discipline, have learned together to utilize the tools of continuous quality improvement (cqi) as an integral part of their problem-solving technique.

Where is it written that it takes two years for an associate degree, four years for a baccalaureate, two years for a masters degree, and forever for a doctorate? Why is U.S. health profession education modeled on German universities of the 17th century?

2.8. Use the ASO to fund demonstration projects with a long-term funding commitment to plan, collaborate, and implement models of different educational and practice pathways.

2.9. The impending nursing shortage is unlike any faced before because the nurse workforce is aging and the pipeline is not full of new recruits. A major reason nurses leave the healthcare field is due to a lack of a collegial working environment and a

lack of trust and respect for nurses on the part of physicians and administrators. A favored way for nurses to show their displeasure is to strike, leave or both. This is a zero sum game and fosters an environment where mistakes occur and are hidden. Not only do students need to learn together, but faculty also need to be retreaded to "walk the walk" and "talk the talk". If one does not believe in it and model it, it is hard to teach it or practice it in a credible manner.

Therefore, use the ASO and the impact of impending demographics to launch a nation-wide public relations campaign to inform the public of the variety of providers needed in the future and market those professions to the public. Request the private sector to design a public relations campaign (and public service announcements with a special section dedicated to minority recruitment) that illustrates unbiased data regarding the need for nurses, as well as the need for a right-sized workforce of all health professionals. Collaborate with Hollywood and cable networks to produce shows like E.R. (not exactly) that highlight the reality of professional and advanced practice nursing and its flexibility as a career.

Question #3: What should the federal government do to further the preparation of faculty for a collaborative systems environment?

Recommendation #3: While this question was partially addressed in #2 Recommendation, the "graying" of nursing faculty is troublesome and real.

Use the ASO to:

3.1 Design incentives for nursing doctoral programs to collaborate on the design of web-based curricula with one another and other health professional schools so each of the doctoral programs do not teach duplicative courses for much of their curricula. This should be accompanied by research grants from other federal agencies to address — hopefully, in a definitive manner — doctoral faculty concerns that doctoral students cannot be well "socialized" except in a traditional, on-site doctoral program.

3.2 Grant financial support to schools in collaboratories to upgrade physician, nurse and allied health faculty teaching skills, as well as hardware, in web-based courses — although, fortunately, the price of hardware is declining. Grant funding to support "BSN (or equivalent) to doctorate" tracks to decrease the age at which nurses receive doctoral degrees, and provide incentives for designing quality, interdisciplinary programs of reasonable length.

Question #4: What specific project could be designed to demonstrate the preparation of faculty to work and teach in a collaborative systems environment to ensure patient safety?

Recommendation #4

Use the ASO to:

4.1. Fund and use the concepts and meta-analysis methodologies of the Campbell Collaboration (2000) (similar to the Cochrane Collaboration (1993)) to document, maintain and promote access to the systematic reviews of the previous results of attempts of interdisciplinary education and practice so that successes can be expanded without re-work. Such previous efforts should include the John A. Hartford Geriatric Interdisciplinary Team Training Program with the set of care measures (which might form one of the selected evaluation measures used across projects by the ASO) (Fullmer and Hyer 1998), the results of the federally funded Rural Interdisciplinary Care Projects such as the one located at the University of South Florida (Burns, Smith, Hyer, Jacobson, Lowry, Reed, and Westhoff 2000), which cited three not-surprising barriers to interdisciplinary education and practice — (heterogeneity of students resulting from inherent differences in student selection and class schedules employed by different schools, the wide variation in students' experience bases, and the relative fullness and rigidity of the medical school curriculum).

4.2. Require specific recommendations as to how medical, nursing and allied health educational activities can be held more accountable for cost-effective care with more successful patient outcomes across delivery systems. Structure proposals and financial support for collaborative projects in such a manner that one group will not be able to achieve a successful outcome without collaboration with other groups, and without imbedding a systems approach to CQI into core interdisciplinary curriculum.

4.3. As part of the effort to right-size the number of providers, identify federal interdisciplinary projects — such as the National Health Service Corps and the Interdisciplinary Rural health Projects — and adjust funding to support the number of students from each discipline needed to achieve to meet workforce projections. Level the playing field so nursing and allied health students can reap the same benefits from such federal projects as physician students as numbers relate to a "right-sized" workforce.

Attachments to Conway Paper:

Attachment 1: The Campbell Collaboration

Attachment 2: The LeapFrog Group

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Attachment 1

THE CAMPBELL COLLABORATION

A Brief Introduction

The Campbell Collaboration is an emerging international effort that aims to help people make well-informed decisions by preparing, maintaining, and promoting access to systematic reviews of studies on the effects of social and educational policies and practices.

The Campbell Collaboration is named after an American psychologist and thinker, Donald Campbell, who drew attention to the need for societies to assess more rigorously the effects of their social and educational experiments, that is, the policies and practices that they introduce and promote. These experiments take place in pre-school, elementary, secondary and higher education; in delinquency and criminal justice; in mental health and substance use; and in social services, including welfare, housing, and employment and training.

The decision to establish the Campbell Collaboration was taken by 80 people from four countries at an exploratory meeting at University College London in July 1999. The Collaboration was formally established at a meeting at the University of Pennsylvania on February 24-25, 2000.

The systematic reviews of research evidence prepared and maintained by contributors to the Campbell Collaboration's Review Groups will be designed to meet the needs of those with a strong interest in high quality evidence on "what works". These include members of the public who want to keep abreast of the best evidence on the effects of social and educational policies and practices, service providers, policy makers, educators and their students, and professional researchers. Campbell systematic reviews will be published electronically so that they can be updated promptly as relevant additional evidence emerges, and amended in the light of criticisms and advances in methodology.

The Campbell Collaboration will collaborate closely with its sibling organization - the Cochrane Collaboration – which prepares and maintains systematic reviews of the effects of interventions in health care (see www.cochrane.org). The nine key principles on which the work of both collaborations is based are:

- Collaboration, by internally and externally fostering good communications, open decision-making and teamwork.
- Building on the enthusiasm of individuals, by involving and supporting people of different skills and backgrounds.
- Avoiding unnecessary duplication, by good management and co-ordination to ensure economy of the effort.
- Minimizing bias, through a variety of approaches such as abiding by high standards of scientific evidence, ensuring broad participation, and avoiding conflicts of interest.
- Keeping up to date, by a commitment to ensure that Campbell Reviews are maintained through identification and incorporation of new evidence.
- Striving for relevance, by promoting the assessment of policies and practices using outcomes that matter to people.
- Promoting access, by wide dissemination of the outputs of the Collaboration, taking

advantage of strategic alliances, and by promoting appropriate prices, content and media to meet the needs of users worldwide.

- Ensuring quality, by being open and responsive to criticism, applying advances in methodology, and developing systems for quality improvement.
- Continuity, by ensuring that responsibility for reviews, editorial processes and key functions is maintained and renewed.

Because concern about the quality of evidence transcends the respective focuses of the Campbell and Cochrane Collaborations, and because the science of research synthesis is still young, joint Cochrane-Campbell Methods Groups are being established. Their objective is to stimulate the empirical methodological research required to improve the validity, relevance and precision of systematic reviews and the randomized trials and non-randomized trials on which they are based.

The evolution of the Campbell Collaboration is being coordinated by a Steering Group, with members nominated and confirmed by those attending the exploratory meeting 1999, and the inaugural meeting in 2000. People who wish to consider becoming contributors to the Campbell Collaboration should contact one of the people named below, providing information about their field of interest and the way they would like to contribute to the work of the Collaboration:.

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Attachment 2

THE LEAPFROG GROUP

SPONSORED BY THE BUSINESS ROUNDTABLE FACTSHEET

The Leapfrog Group

The Leapfrog Group is a Business Roundtable-sponsored commitment to mobilize employer purchasing power to initiate breakthrough improvements in the safety and the overall value of healthcare to American consumers. It is a voluntary program aimed at mobilizing large purchasers to alert America's health industry (both directly and via health plans) that big leaps in patient safety and customer value will be recognized and rewarded with preferential use and other intensified market reinforcements.

The idea behind Leapfrog began in 1998 out of concern over the safety and value of American health care. The recent Institute of Medicine's (IOM) reports on quality in 1998 and safety in 1999 revealed widespread failures in treatment planning and execution. To help address these problems, the report recommended that large purchasers provide more market reinforcement for quality and safety - further validating The Leapfrog Group's strategy.

Leapfrog's Mission

Our mission is to trigger a giant leap forward in quality, customer service and affordability of health care of all types by:

- making the American public aware of a small number of highly compelling and easily understood advances
- in patient safety; and
- specifying a simple set of purchasing principles designed to promote these safety advances, as well as
- overall customer value.

This effort is rooted in four foundational ideas:

- American health care remains very far below obtainable levels of basic safety and overall customer value.
- The health industry would much more rapidly improve if purchasers better recognized and rewarded superior safety and overall value,
- Voluntary adherence to purchasing principles by a critical mass of America's largest employers would provide a large jump-start and encourage other purchasers to join.
- These principles should not only champion superior overall value, but specifically focus on a handful of specific innovations offering "great leaps" in basic patient safety to maximize media/consumer support, and adoption by other purchasers.

Initial Leaps in Patient Safety

After consultation with national quality experts, we selected three "safety leaps" for initial focus. These are currently in final stages of refinement prior to their expected public release in spring 2000.

(1) Computer Physician Order Entry (CPOE)

Physician order entry in hospitals should be computerized. Adverse drug treatments are the leading cause of avoidable death and disability in American hospitals. CPOE has been shown to reduce serious prescribing errors in hospitals by more than 50%, yet less than 3% of hospitals use it.

(2) Evidence-based Hospital Referral (EHR)

Patients requiring selected complex treatments should routinely be referred to hospitals which offer the best odds of survival, based on risk-adjusted hospital performance comparisons (when available), or based on a hospital's annual volume of such treatment. Research indicates that such referrals could reduce a patient's risk of dying by more than 30% for some treatments.

(3) ICU Physician Staffing Standard

Physicians with credentials in critical care medicine should at least, during the day, actively monitor

patients in ICUS. The current scientific evidence indicates that risk of death could be reduced by more than 10%.

This initial list is based on four primary criteria:

(1)There is overwhelming scientific evidence that these safety leaps will significantly reduce avoidable danger.

(2)Their implementation by the health industry is feasible in the near term.

(3)Consumers can readily appreciate their value.

(4)Health plans, purchasers or consumers can easily ascertain their presence or absence in selecting among health care providers. These safety leaps are intended as a practical first step in using purchasing power to improve patient safety.

Because the health industry needs lead time to meet these standards, we have set *aggressive but feasible* target dates for purchaser application of the standards. None of these standards will have target dates later than 2004.

The Business Roundtable

The Business Roundtable is an association of chief executive officers of leading corporations with a combined workforce of more than 10 million employees in the United States. The chief executives are committed to advocating public policies that foster vigorous economic growth — a dynamic global economy; and a well-trained and productive U.S. workforce essential for future competitiveness.

The BRT's member companies serve as the primary source of health insurance coverage for most of their 10 million-plus employees and their families - approximately 25 million Americans. All BRT companies have multi-state operations. Sixty percent of its members operate in more than 40 states.

Learning to Improve Complex Systems of Care

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Dr. Headrick is Professor of Medicine, Center for Health Care Research and Policy, Case Western Reserve University at MetroHealth Medical Center. She received her M.D. from Stanford University, served as Chief Resident in Medicine at the University of Maryland, and is a Visiting Professor to the Institute of Health and Community Studies, Bournemouth University, U.K.

Dr. Headrick is internationally known for her work in continuous quality improvement and interdisciplinary health professions education. Since 1994, she has led a series of demonstration projects known as the Interdisciplinary Professional Education Collaborative (IPEC), sponsored by the Institute for Healthcare Improvement and the Bureau of Health Professions/Health Resources and Services Administration. This work resulted in over 25 peer-reviewed publications, including special issues of the Joint Commission Journal of Quality Improvement in 1996, Quality Management in Health Care in 1998, and the Journal of Interprofessional Care in 2000. She also co-founded and co-chairs the Special Interest Group on Quality Improvement in Medical Education of the Group on Educational Affairs at the Association of American Medical Colleges.

At MetroHealth Medical Center, Dr. Headrick leads the Catalyst initiative, with the goal of improving education and patient care in primary care practice. In 1999, she initiated a new MetroHealth-supported health professions fellowship, Faculty Scholars in the Improvement of Health. At Case Western Reserve University School of Medicine, she served as Principal Investigator of the Robert Wood Johnson Foundation-supported Generalist Physician Initiative. She continues to work as Director of the School of Medicine's Primary Care Track.

Learning to Improve Complex Systems of Care

Linda A. Headrick, M.D., M.S.

Safety is a critical first step in improving quality of care.

Kohn et al, 1999[1]

Prevention of future errors requires changing systems.

Leape et al, 2000[2]

The message is clear. Preventing medical error and improving patient safety are top priorities. There is compelling evidence that we are failing to meet our professional mandate to "do no harm," and the American public is demanding action. At the same time, our health care system is complex; one hospital found that it takes 60 steps to administer a routine medication to a newly admitted patient.[3] Change in complex systems is difficult. The task of preventing error feels overwhelming.

Lessons from other complex, high-risk industries such as aviation, petrochemical processing and nuclear power suggest some answers that are being applied to health care.[2,4-6] In a recent initiative sponsored by the Institute for Healthcare Improvement, 36 hospitals collaborated in their efforts to reduce medication error.[2] They found that a combination of interdisciplinary teamwork, improvement methods and human factors principles for reducing error led to improvement in a substantial portion of change attempts. Successful efforts to change systems and prevent error tended to have:

- Strong leadership
- Aims that were clearly defined and "relentlessly" pursued
- Careful use of an improvement model
- Measures of progress
- Interdisciplinary teams
- Early involvement of stakeholders
- Practical interventions that changed processes, redesigning the work "to make errors difficult to make."

Interventions that failed included those that were limited to education, information dissemination and rule changes. These strategies are less powerful. They rely on telling people what to do, rather than changing the system to make it easy to do things right...or impossible to do them wrong.

Many health professionals who desire to create safer health care systems come to the task with a significant handicap: They have little familiarity with what is known about making change successfully, ensuring that it is an improvement, and having it endure. Their professional knowledge (i.e., basic and clinical science, interpersonal skills, values) is critically important, but may not be sufficient when the task at hand involves a complex system. The same is true for those who seek to improve health care in general. Professional knowledge ("the literature says this is the best approach") must be combined with knowledge for improvement ("how can we make it happen consistently for patients here?").[7,8] The latter are competencies that help people improve the processes and systems in which they work. At the core is the use of evidence to identify changes, plan a test and assess the results.

Since the early 1990's, many health professional educators have worked to discover effective ways for young professionals to gain knowledge and skill in improvement as part of their core professional preparation.[9-16] This includes the skill in interdisciplinary teamwork they will need to improve complex care processes and systems. The goal of this paper is to summarize what has been learned so that it can be applied to collaborative education to improve patient safety.

Helping Young Professionals Learn to Improve Health Care

With input from educators across multiple professions, the Institute for Healthcare

Improvement identified the following eight domains of core content in improvement learning:[17]

1. **Customer / Beneficiary knowledge**: Identification of the person, persons, or groups of persons for whom health care is provided; assessment of their needs & preferences and the relationship of health care to those needs and preferences.

2. **Health care as process, system**: The interdependent people (patients, families, eligible populations, caregivers), procedures, activities, and technologies of health care-giving that come together to meet the need(s) of individuals and communities.

3. **Variation and measurement**: The use of measurement to understand the variation of performance in processes and systems of work .

4. **Leading, following and making changes in health care**: The methods and skills for making change in complex organizations, including the general and strategic management of people and the health care work they do. Such activities include a general understanding of health care financing, information technology, the roles that individuals of different professions play in daily health care-giving and the development of a supportive internal organizational climate for working, learning and caring.

5. **Collaboration**: The knowledge, methods and skills needed to work effectively in groups, to understand and value the perspectives and responsibilities of others, and the capacity to foster the same in others.

6. **Developing new, locally useful knowledge**: The recognition of the need for new knowledge in personal daily health professional practice and the skill to develop new knowledge through empiric testing.

7. **Social context & accountability**: An understanding of the social contexts (local, regional, national, global) of health care and the way that expectations arising from them are made explicit. This specifically includes an understanding of the financial impact and costs of health care.

8. **Professional subject matter**: The health professional knowledge appropriate for a specific discipline and the ability to apply and connect it to all of the above. Core competencies published by professional boards, accreditors and other certifying entities are appropriate here.

Improving health care is a skill-based professional activity. Developing competency requires a combination of theory and practice.[12,14,16,18] Students asked to limit their work to observing improvement activities voice the same frustrations that students express when they walk with a clinician-teacher seeing patients and but are never allowed to talk with the patients themselves. Learners want the challenge and feedback of trying to contribute actively to the work. Three students (two from medicine and one from nursing) who participated in early interdisciplinary learning experiences about the improvement of health care wrote:[19]

"Learning is most easily accomplished when lessons can be placed in a context and opportunities exist to apply the lessons learned. Without this chance, lessons learned are soon forgotten."

There are a variety of useful models for improvement learning in professional training.[12,15,20,21] Most involve a combination of didactic (classroom sessions, small group seminars or self-study) and experience-based strategies.

The personal improvement project is an efficient way to introduce core principles and methods.[15,16] Each learner chooses a goal in an area of personal interest (recent examples include reducing weight, drinking more water, and getting to class on time), identifies an appropriate measure of outcome, studies the process to generate hypotheses about what might be altered to achieve improvement, and tests at least one change.[22] The advantage of a personal project is that changes can be carried out by the learners themselves, often without negotiation with others. The resulting "walk-through" of the improvement process is easy, fun and often personally rewarding.

Deeper learning requires experience in the health care setting. As part of a required course in community-based primary care, Weeks and colleagues asked medical students to design and conduct an

improvement project in partnership with the physicians supervising their clinical work.[20] Residency directors are introducing improvement activities into graduate medical education, where the structure lends itself to project work that can be done longitudinally, over time.[10,21] In nursing, Kyrkjebo and colleagues integrated improvement into clinical practice courses.[15] They report a group of students who studied patient satisfaction in a pediatric radiology service. The students identified patient concerns about information, interaction with the staff and waiting times. As a result, the professional staff updated patient information materials, revised staff training and began work to identify ways to shorten the amount of time patients spent waiting.

Interdisciplinary Education in the Improvement of Health Care

Improvement in health care is almost always an interdisciplinary process, requiring the expertise and collaboration of everyone who works in the system to be redesigned. The professionals involved must be ready to contribute their own knowledge and skills and be willing to learn from the expertise of others.[23] Each must also be aware of differences such as language and methods of work that, unrecognized, can interfere with effective collaboration.

Uni-disciplinary educational activities can build some of the competencies needed for improvement work, but not all. Attempts to teach improvement that begin with one discipline nearly always involve others as soon as they extend to the care setting.[15,20] For this reason, many argue that interdisciplinary experiences should occur early in training, before learners become "isolated in their discipline-specific domains and 'tainted' by traditional disciplinary hierarchies, boundaries and biases."[24] In physician training, for instance, many feel that residency is too late to introduce the concepts of interdisciplinary collaboration. When Parker and colleagues added residents to interdisciplinary teams for geriatrics learning, they discovered that some had negative attitudes about team work and discomfort with an approach in which "the physician was part of the team as opposed to being the sole decision-maker."[25]

THE NEED FOR ACTIVE LEARNING

The largest published experience in interdisciplinary education in improvement is the Interdisciplinary Professional Education Collaborative, a demonstration project sponsored by the Institute for Healthcare Improvement and the Health Resources and Services Administration/Bureau of Health Professions.[12,14,16] Starting with four sites in 1994, interdisciplinary teams of faculty designed and tested learning experiences about the improvement of health care for students in health administration, medicine, nursing and other disciplines. They repeated a discovery about interdisciplinary education reported by others over the years: the need for of active learning and the power of learning in the context of meaningful work.[26] Students involved in projects where they could see a benefit to patients were energized and enthusiastic. Projects focused on a specific patient or community need brought the disciplines together and highlighted the value of interdisciplinary collaboration.[16]

When the collaborative expanded to ten sites in 1997, the focus on experiential learning was directed to the health of communities.[27] Interdisciplinary teams of students applied improvement methods to a wide-ranging set of issues. A few examples include access to health care for the homeless in Philadelphia, smoking prevention for young children in Rochester NY, immunizations for the elderly in western Oregon, and self-care for people with diabetes in rural South Carolina. Knapp et al describe how educational activities such as these can provide benefit to both learners and communities.[27]

For learning to occur in the context of meaningful service to others, it must take place in the settings in which such service occurs. In most instances, this requires collaboration between the faculty members designing educational experiences and the professionals who work in health care or other community organizations. Learners can join an improvement team that includes professionals from the sponsoring organization or, as a student team, they can work more independently on a small portion of a larger project,.[12,27-29] The former usually requires a longitudinal commitment of several months, but brings with it the advantage of relationships with

other professionals over time. The latter may work best when the time available is short.

PROJECT SELECTION AND PREPARATION

Table 1 summarizes recommendations for selecting projects, preparing learners for the work and preparing host organizations for the learners. First, the goal of the project must be consistent with the overall goals of the organization.[21,28,29] Even if much of the work is being done by students, organizational staff time and other resources will be required. The project must be important enough to merit this investment.

The project goals must be achievable in a time period consistent with the learners' availability. Learners and organizations work on different time-scales. Many professional graduate programs are scheduled by the semester. Others organize activities and responsibilities into month-long assignments. Even the "rapid-cycle change" of the collaborative to reduce adverse drug events described above occurred in the context of a 15-month commitment.[2]

Table 1: Improvement Projects for Interdisciplinary Student Learning

Project Selection	• Goal of the project in alignment with the overall goals of the sponsoring organization. • Goals achievable in a time period consistent with the learners' availability. • Presence of a member of the sponsoring organization willing to act as a mentor. • Site willing to give learners access to pertinent information and have procedures in place to ensure confidentiality.
Preparing organizations for learners	• Goal of the project and how it fits with overall organizational goals clear to everyone affected. • Clear roles for organizational project mentor and responsible faculty. • Routine methods of communication among learners, faculty members, and organizational mentors.
Preparing learners	• Clear goals, expectations, roles and responsibilities. • Specific instructions for obtaining agreement on end-products and a plan for regular communication with the project's organizational mentor. • Guidelines for appropriate professional behavior, if the learner is a visitor to the sponsoring organization. • Enough basic information about improvement methods to give students confidence that they can get started.

The rapid-cycle model helps with this dilemma, however, in that each improvement initiative is broken up into a series of learning cycles.[32] By focusing on one or two smaller cycles of change, learners can complete a project in the time available and contribute to the overall endeavor.[27,30] Horak et al suggest strategies for the required hand-offs at the end of the learners' project time: minutes of all meetings, a notebook of materials detailing work to date, a summary report, and a "transition meeting" involving learners and site personnel to identify key interventions, lessons and follow-up actions.[28]

A staff member based at the sponsoring organization is needed as a project mentor for the learners and a liaison to the rest of the organization.[16,20,28,31] That person must ensure that everyone affected by the project is aware of what is happening (and why), provide necessary introductions, and make certain that learners have access to information and other required resources. Project preparation also includes delineation of the roles of organizationally-based project mentors and the responsible faculty members.[28] Who will the learners turn to for what? How routine will communications occur? What if a problem arises?[27,31]

Finally, the learners must understand the goals of the project and their own roles and responsibilities.[28] They must start by meeting with the project mentor and develop agreement on expectations and end-products. Some faculty find it useful to provide explicit instructions to help learners with this step.[31] It may also be important to provide instructions about appropriate professional behavior and confidentiality, especially for learners early in their professional training.

DIDACTIC INSTRUCTION AND REFLECTION

It is uncertain how much "up front" instruction about improvement is needed before project work can begin. This should include at least an introduction to core improvement principles and the basics of effective group process.[33] One faculty team in the Interdisciplinary Professional Education Collaborative tested three variations of classroom instruction before the students began their project work: one using half of a semester-long course, one with an introductory week and the third with almost no up-front core presentation. They felt that students progressed most quickly in their project work with the second approach.[16]

All the published models of interdisciplinary education in improvement include ongoing instruction and reflection. Formal instruction often includes a mix of seminars, electronic communications and self-study. Methods of reflection range from individual learner journals to structured student team self-assessments.[28,34]

With this heavy emphasis on experience-based learning, the faculty role involves considerable coaching.[18,35] Many express concern about a lack of direct experience in improvement, and although most have worked with professionals from other disciplines, few have prior training in teamwork or knowledge of the supporting literature.[15,36] Faculty development usually requires attention to these areas of content. As is true for students, faculty learning is accelerated through experience and reinforced through opportunities to share the results with others.[14,18]

THE CHALLENGES OF INTERDISCIPLINARY LEARNING

The challenges and barriers to interdisciplinary learning in improvement mirror those found in interdisciplinary education in general. Table 2 lists several of these, along with helpful actions that can be taken by academic leaders. A major barrier that for many is a "stopper" is the simple issue of getting learners from different disciplines together. Even within one university, health professional programs often have different academic calendars, with major differences in start- and end-dates and other details of individual course scheduling.[23,37] One interdisciplinary graduate course involving two universities and four graduate programs involved students with three different weeks scheduled for spring break. Potential solutions are to 1) identify places where students already are in the same place at the same time, such as clinical teaching sites;[36] 2) identify and reserve common times for interdisciplinary meetings;[14,28,38] and 3) minimize the number of face-to-face gatherings needed with the use of asynchronous communications such as email and electronic bulletin boards.[16,28,39,40]

Table 2: Challenges in Interdisciplinary Education and Actions for Educational Leaders	
Challenge	**Action**
Mismatched schedules	• Identify settings where learners already come together, e.g. clinical sites • Identify and reserve common times for seetings • Use asychronous communications, such as email and electronic bulletin boards
Design learning exercises in which differences are made explicit	• Design learning exercises in which differences are made explicit • Develop a common vocabulary
Differences in routine methods of work	• Use standard meeting management and group process techniques
Differences in academic policies (e.g. grades v. pass/fail)	• Ensure that academic credit is appropriate and fits discipline-specific program requirements • Build in individual student assessment as well as assessment of team results
Variation in learners' age, education level and clinical experience	• Match level of learner where appropriate • Recognize and work with the differences
Already over-crowded curriculum	• Integrate new learning experiences into the required curriculum, linking with other subject matter
Complexity of design requires considerable faculty commitment and time	• Create opportunities to share ideas and strategies with others within and across institutions
Discipline-specific processes for faculty recognition and rewards	• Create incentives and rewards that encourage faculty participation in interdisciplinary activities • Develop academic products • Share the rewards fairly and in a way that is meaningful to discipline-specific evaluation systems

Differences in the professional language used by the various disciplines can lead to misunderstandings and even ill feelings.[41] One example is the word "patient." Some disciplines view "patient" as a term with long-standing historical importance and respect, as in the context of the patient-doctor relationship.

Other professions see "patient" in the context of the sick role, in which one person becomes dependent and even subservient to another. Disagreements such as these are long-standing and unlikely to be resolved easily. Instead, faculty can make the differences explicit, help their learners understand the important values that lie behind strong discipline-based feelings, and develop agreement on a common vocabulary to be used in a particular setting.[14,16]

Similarly, differences in routine methods of work can create disharmony if assumptions are unstated and expectations disappointed. As in the work of groups in general, up-front agreement on standard methods for work and decision making helps the participants plan more effectively, encourages them to voice their opinions and allows attention to be focused on the content rather than the process of the task at hand.[30,33,41]

Differences in academic policies pose yet another challenge. In interdisciplinary settings, it is not uncommon to have learners from programs in which evaluation is pass/fail mixed with learners who must earn a letter grade. Even within one university, programs may count credit "hours" differently for the same amount of work. Some universities have attempted to establish a common set of rules for learning activities designated as "interdisciplinary," but these are difficult to maintain. The reality is that degrees are awarded by specific schools and disciplines whose faculty establish their own requirements and guidelines. A practical approach is to understand the specific rules for each program and ensure that learners are evaluated in such a way that they will receive appropriate academic credit in their individual programs of study.[42]

Interdisciplinary groups of learners may have significant variation in their age, education level and degree of clinical experience.[41] "Matching" the learners may not always be possible. Recent experience suggests that learners with different backgrounds and preparation can work well together. This may reflect careful attention to ground rules and expectations for group process and behavior.[12,43]

The already-crowded curriculum can be another barrier to attempts to introduce interdisciplinary education. Knowledge and skills in improvement and interdisciplinary collaboration are tools for achieving the goal of making best care happen consistently for our patients, day-to-day. As such, learning about them can be linked with other subject matter already a part of the core curriculum. There are several examples in which this has been done successfully, ranging from patient-based case conferences to rural experiences in primary care.[36,39,42]

The discussion above gives evidence to the complexity of design inherent in interdisciplinary education. Considerable faculty commitment is required. At the same time, faculty recognition and rewards are most often discipline-specific and focused on individual rather than team-based contributions. Academic leaders who wish to promote interdisciplinary education must create faculty incentives and rewards in alignment with that goal.[36,38] Lessons about effective and efficient teaching strategies can move from one place to another if there are opportunities to share ideas across institutions.[12,14,23,36] Multi-institutional collaborations also increase opportunities for generating academic products, with recognition for individual contributors.[12,18]

CHANGING AND IMPROVING EDUCATION ITSELF

The methods and principles for improving health care, including patient safety, are also useful for creating change and improvement in health professions education.[14,23] The educators leading the Interdisciplinary Professional Education Collaborative felt it imperative to create education that "embodies knowledge for improvement," with faculty modeling the behaviors they wish their learners to adopt.[12]

Leape et al identified strong leadership, clearly defined aims, careful use of an improvement model, measures of progress, interdisciplinary teams, early involvement of stakeholders, and practical changes in work processes as key components of successful efforts to improve patient safety.[2] These same factors, including the Model for Improvement used by the patient safety collaborative, can help improve education.[16,23,30] The model consists of three questions plus a series of pilot tests or learning cycles.[32] The three questions are: "What are we

trying to accomplish?" (the goal); "How will we know that a change is an improvement?" (the measures); and "What change can we make that will result in improvement?" (interventions which are worth testing).

The concept of a series of learning cycles allows one to start with a large overall goal and break it into smaller, more achievable steps. Each becomes the focus of a cycle of change to test a specific action, measure the results and plan for the next test. This sequence of data-driven inquiry moves from theories and hunches about what might make things better to demonstrable improvement.[32]

Across the Interdisciplinary Professional Education Collaborative, the following additional lessons about making change in educational organizations emerged:[16]

1. *It is useful to identify outside support/pressures to start the change.*

All of the Collaborative teams took advantage of national-level professional recommendations, accreditation requirements, foundation interest and community pressures to stimulate change. To generate local support for interdisciplinary learning in improvement, faculty cited requirements for continuous improvement in Health Resources and Services Administration grant programs, National League of Nursing accreditation criteria focusing on data collection and outcome measurement, and the Medical School Objectives Project's inclusion of learning objectives for improvement skills and constructive attitudes about interdisciplinary work.

2. *It is possible to accelerate learning and improve the generalizability of results by collaborating across institutions.*

One of the most commonly cited benefits of being part of the Interdisciplinary Professional Education Collaborative was the value of learning with others doing similar work. Participants shared educational strategies such as models for community-based learning and ideas for faculty development. They exchanged educational materials such as self-study manuals, a workbook for personal improvement projects, and web-based learning modules. They discovered repeated observations across sites worth sharing with others, resulting in a number of peer-reviewed publications.

Recommendations for Policy Makers

This paper has sought to summarize lessons from interdisciplinary education in the improvement of health care so that they can be applied to efforts to ensure patient safety. Those seeking to create interdisciplinary learning to reduce medical error will be able to build on this foundation, but they still will need to design and test new teaching and learning strategies, preferably in a way that will build knowledge useful to others.

Most of the lessons described here apply to actions for educational organizations and faculty. What, in addition, can policy makers do? This author offers the following recommendations:

SUPPORT FACULTY DEVELOPMENT AND TRAINING

To establish successful interdisciplinary education in patient safety, faculty need opportunities to gain knowledge of the pertinent content and build skill through work in which they are guided and coached. (This is not unlike what they will seek to do for their students.) Cleghorn and Baker argue that faculty learning is accelerated in an environment where everyone is learning and it is acceptable to admit what one doesn't know. Even better are environments where, in addition, informal social pressures set expectations for steady progress.[18] As national health policy leaders work to encourage collaborative education to ensure patient safety, a clear delineation of the new content should be combined with opportunities for faculty learning and practice.

CREATE OPPORTUNITIES FOR COLLABORATIVE LEARNING ACROSS INSTITUTIONS.

This paper already has discussed some of the benefits of creating educational change in the context of a multi-institutional collaborative. These can be summarized as follows:[14,16,23]

- Shared learning methods & tools

- Shared resources for faculty development
- Learning from other participating sites
- Social support and motivation for participants to maintain their commitment
- Access to expert advisors and mentors
- Higher visibility and image for the work among institutional leaders
- National-level platform for innovation
- Better data for decision-making, with observations gathered from several sites.

Successful collaborative work requires an overall agreement on goals and acceptance of ground rules to foster shared learning.[23] The Interdisciplinary Professional Education Collaborative began with a specific set of ground rules, including: 1) No stealing. 2) Share openly. 3) Protect each other's future. 4) Honor your commitments when working together. 5) Guard trust. 6) Have fun together. 7) Evaluate honestly what has gone well, what might be improved, and what has been learned thus far.[12] National policy makers should create similar opportunities for cross-institutional learning about collaborative education in patient safety.

OTHER SUPPORT FOR THE CHANGE

What else can support the change needed? Gustafson and colleagues described four drivers of change: tension for change, a superior alternative, skills and self-efficacy, and social support.[45] Recent events have created a considerable tension for change, with a strong public message that the current level of error in health care environments is unacceptable. The faculty development efforts and opportunities for collaborative learning recommended above will create new models of education to promote patient safety and faculty who are competent to carry them out.

What about the fourth change driver, "social support?" In addition to material resources to support innovation and evaluate the results, leaders in professional organizations, health professional education regulatory agencies and governmental bodies must provide social support. According to Gustafson, that means helping those working to make the change believe that the people they respect agree with the change, are working toward it themselves, and will do what they can to help it succeed.[45] For educational leaders and professional organizations, that means establishing ways to recognize and reward faculty who are improving education in patient safety and interdisciplinary teamwork. For regulatory agencies, that means establishing an expectation that pertinent competencies will be gained as part of core professional preparation. For governmental bodies, that means sponsoring programs that will accelerate learning and innovation.

Conclusion

"Prevention of future errors requires changing systems."[2] Ensuring patient safety means changing the complex systems in which health care occurs. That requires knowing the principles for reducing error and the ability to work with other health professionals to achieve change and improvement. It is possible to include education in these areas as part of core professional preparation, but that means also changing the complex system in which health professional education occurs. Knowledge, skill and action are required of faculty, academic leaders, and leaders in health policy.

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Using Clinical Computing to Enhance Physician and Nurse Collaboration and to Improve Patient Safety

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Using Clinical Computing to Enhance Physician and Nurse Collaboration and to Improve Patient Safety

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Introduction

It is clear from work done more than two decades ago that computer systems can help prevent errors in medicine [1]. David Eddy framed the problem of the complexity of medicine well in a 1990 series of articles in the Journal of the American Medical Association on clinical decision making [2]. "It is simply unrealistic to think that individuals can synthesize in their heads scores of pieces of evidence, accurately estimate the outcomes of different options, and accurately judge the desirability of those for patients. ....all confirm what would be expected from common sense: The complexity of modern medicine exceeds the inherent limitations of the unaided human mind."

The Institute of Medicine (IOM) in its recent report "To Err is Human" [3], and the Report of the Quality Interagency Coordination Task Force (QuIC) [4] to the President of the United States highlight the magnitude of the problems of errors in medicine and provide some potential solutions. The IOM report states "We must have a health care system that makes it easy to do things right and hard to do them wrong" [3]. Our experience with computerized decision-support systems, also called expert systems, has shown that such systems can assist the care giver to provide better care [5].

How might computers help?

Computers have the potential to help in reducing errors by: a) assisting in data collection, for example gathering timely data frequently from bedside monitors; b) providing better organized displays of results and findings (manual charts present data in only the format recorded, or must be manually transcribed multiple times which is inefficient and leads to errors); c) optimize communications between care givers (typically manual charts can only be viewed by one clinician at a time and at only one location, computerized clinical records are available to all clinicians at multiple locations); d) make medical interpretations and decisions (for example immediately alerting clinicians when a life threatening laboratory result is found), and e) providing more realistic education by simulating a wide variety of clinical events as training exercises. None of us would feel comfortable if the pilot of the commercial aircraft had not had initial training follow-up practice with a simulator as to what to do in a variety of emergency situations. Nor would we feel comfortable with them using the flight we are on to practice!! So although not much has yet been done with care-giving simulations, computers offer the opportunity to give care givers individually and as teams the needed practice experience.

There have been several excellent examples demonstrating the value of using computers in health care not only for administrative purposes, but more importantly for clinical purposes. The HELP system at LDS Hospital in Salt Lake City [5-9] is but one example. The Regenstrief Medical Record System at the University of Indiana School of Medicine in Indianapolis [10], Brigham and Women's Hospital and Beth-Israel Hospital in Boston [11,12], and Columbia University Presbyterian Medical Center in New York City [13] are other examples.

To illustrate that some of the concepts outlined above are not just ideas, but can be beneficial in clinical practice, I will discuss the HELP computer system at LDS Hospital in Salt Lake City. The HELP system has been under development since the early 1970s. Since the initial system's installation it has been expanded to provide sophisticated clinical decision-support capabilities for a wide variety of clinical areas such as the clinical laboratory, nurse charting, respiratory charting, pharmacy, radiology, medical records, etc. The system has: a) been widely accepted by clinical staff (physicians, nurses, therapists, and others), b) shown that computerized clinically oriented decision-support is feasible and well accepted; c) been shown to provide

improvements in patient care and help minimize errors; d) helped provide more cost-effective care; and e) helped to improve communications between care givers [5-9].

Figure 1 shows a block diagram of the HELP system as it is currently installed in 9 of Intermountain Health Care (IHC) hospitals, including LDS Hospital [5]. Coded data flows into an integrated database from a large number of sites. For example, input includes laboratory data from the clinical laboratory computer system, data from bedside patient monitors in the Intensive Care Unit (ICU), medications ordered and given, surgery schedule and other similar information as indicated in Figure 1. A unique capability of the HELP system is that it can take the coded data stored in the integrated record and make decisions based on that data. The decision-making capability is highlighted on the left panel of Figure 1. The knowledge base block represents the "rule sets" used by the system, the rule sets are then executed by the Decision Making Processor which takes data from the integrated data base and applies the rules. Based on these rules the system can provide data for review by clinicians, alerts, computations, interpretations and even care directing protocols.

Careful reflection indicates that medicine is inherently an information science. For clinicians, the better the knowledge and information that is available: a) the better they can diagnose; b) the better they can counsel and advise their patients; c) the better treatments they can offer; and d) the better outcomes that can be achieved. Further, based on several decades of experience, it is clear "If you can't measure it, you can't manage it!" Applied to medical errors, this statement means that if we don't know about the medical errors that occur and we don't have accurate methods developed to measure and monitor them, it is unlikely that we will be able to minimize the errors.

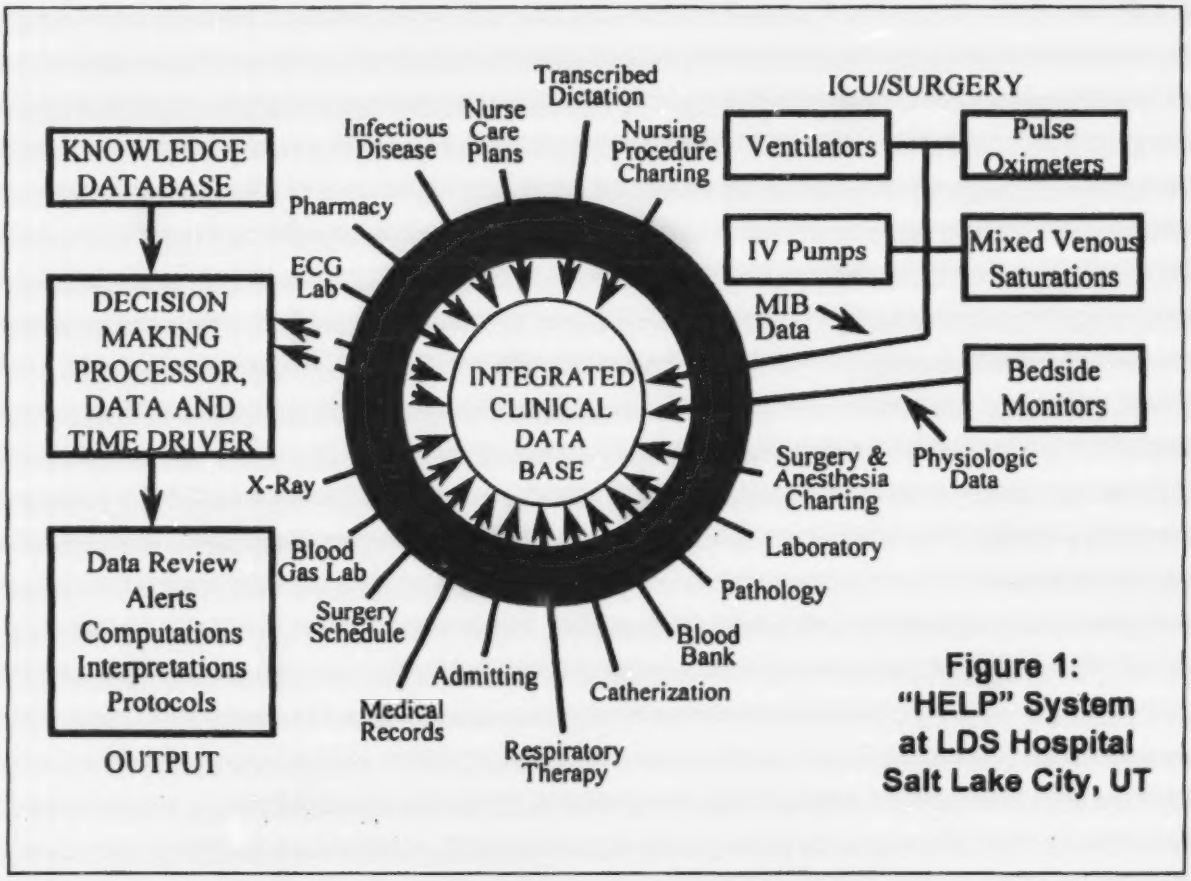

Figure 1: "HELP" System at LDS Hospital Salt Lake City, UT

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Dr. Brent C. James, Executive Director of the Institute for Health Care Delivery Research at Intermountain Health Care, and a participant at this conference has provided us excellent instruction on the methods and strategies of quality improvement [14-18]. He has asked us the following questions as we have applied computers to medicine: Are we doing the right thing? Are we doing things right? And finally how can we be certain that the right thing is done right the first time and every time?

CLINICAL COMPUTING EXPERIENCES AT LDS HOSPITAL

Since the HELP system at LDS Hospital has been successful as both a data gathering and reporting system as well as a computerized expert system, I felt it was important to outline several factors that have lead to this success. Application of these concepts to other sites and to the reduction of medical errors should provide tools for developers and new users of clinical information systems.

DATA COLLECTION ISSUES AND THE USE OF "FREE TEXT"

Using computers for integrating clinical data shifts the management paradigm from a financial and administrative model to a clinical process model. The core way we actually accomplish our work as clinicians changes and we add value to the health care system. For example, if a nurse charts that a medication is given into a clinical computer system, that data provides the fundamental clinical information for the patient record, communicates the data to all care givers, can easily send the information to an administrative system to provide "billing" and "inventory" updating and provides key information for quality assurance activities.

The format and content of data stored in a clinical computing system is crucial to all further uses of that data. Unfortunately, much of the current medical record is stored as "free text." That free text may be in illegible hand writing on paper pages in the medical record or more optimally the text may be in the form of transcribed dictation which was produced by a transcriptionist using a word processor with a spell checker. Having the text data made available in electronic form is certainly more useful than having it only on paper in hand written form. However, having the data in "free text" form is not very useful for computerized decision support. Clement J. McDonald, MD has said "There is nothing FREE about free text!" The reason for this statement is that patient record data in free text format has primary value only to clinicians who read it and not to computers that might process the data. For example, based on the dictation of the radiologist's report of a chest X-ray there may be evidence of pneumonia. Having the knowledge that the chest X-ray containing that information would be very valuable to a computerized expert system being used to optimize ordering of antibiotics for a patient with pneumonia. Because of the almost infinite number of ways such a report can be dictated and the "clarity" of the way the radiologist dictates the data, information content can be lost in the process [19,20].

There are still other concepts that need to be considered in the data collection process: a) What data are needed? b) How frequently are the data needed? c) Who supplies the data? d) How do you collect the needed data? and finally e) How reliable are the data? When considering WHO supplies the data one might consider some of the following alternatives: 1) Automated instruments such as an ICU bedside monitor or a laboratory instrument; 2) Nurses, who are currently the key clinical data collectors for patient observations, medications given etc; 3) Physicians, who in most computerized records contribute only free text; 4) Pharmacists; 5) Respiratory therapists; 6) Medical records staff (ICD-9 coding, etc.); 7) Admitting clerks who provide proper patient identification and family information; 8) Accounting who provides information about the insurance and cost of care information. Just as with manual systems, problems in data collection can cause errors in any one of these situations. Strong and colleagues have recently provided an excellent review of data collection problems that provide important insights into data collection in medicine [20].

Manual chart review of the mix of hand written notes, dictations and other materials is the standard data collection method for almost all medical studies. The advantages of this methodology are that everyone is familiar with it. However, there are lots of disadvantages: a) It is inefficient; b) it is very

expensive; c) it is not "real-time"; and d) the accuracy of the abstracted data is poor.

Computerized patient records offer the following advantages: a) they can be real-time; b) they have excellent accuracy, which can be monitored and improved over time; c) computerized decision support becomes possible; d) cost of collecting and reviewing records can be minimized. However, computerized records currently have the following disadvantages: a) they are difficult to set up; b) the initial expense of installing such a record system is still very expensive; c) mechanisms for entry of coded clinical data quickly, easily and promptly still need improvement; and d) we still struggle with deciding what data to collect. In 1994, Dr. Clement J. McDonald stated "When it comes to gathering information, medicine has not evolved much from the hunting and gathering stages of social evolution."

Data reliability is crucial to all phases of medical care. Based on observations at LDS Hospital we have found that data are more reliable if they are "clinically relevant" or said in another way they are used for clinical decision making. If the data are collected for some obscure or unknown use by a clinician, they are likely to be unreliable. If the data are financially relevant and used for management to make business decisions the data are likely to be reliable.

We have also observed the following with our clinical information system as we monitored and observed nurses and physicians: a) All clinicians love to review patient data; b) Few clinicians like to enter patient data; c) Clinicians are trained and perform virtually all of their practice in "free text"; d) Coded and well defined high quality data are crucial for providing optimal patient care; e) Once clinicians understand the need for coded data they adapt to entering and using it; and f) Age does not seem to be a deterrent to using computerized records. Dr. T. Allan Pryor, a colleague of mine, summarized the current computerized data entry and review problems with the following statements: "a) Everyone wants all the data entry they need done with ONE keystroke and b) Everyone wants all the data they need displayed on one screen or on one sheet of paper." I would add to Dr. Pryor's statement: (a) we must become "smarter" at the art of displaying data; (b) we must have smarter and more efficient methods for entering data (for example a nurse recently said to me "Dr. Gardner, why do we have to read data from one computer screen and enter the data into another computer?"); and (c) everyone - nurse, physician, therapist, clinician, clerk and administrator must collaborate in becoming members of the computerized data entry "team".

Finally, I have observed that: a) Development of better care processes is highly dependent on high quality data; b) Nurses and physicians are currently poorly equipped to use clinical information systems; c) Clinical guidelines and "Evidence Based Medicine" are currently not optimized for computerization [22]; and d) Clinical medicine is still divided into "silos" or "fiefdoms" of care givers and service departments rather than being as collaborative as they should be.

Several examples of how computerized medical records and decision support can improve care have been demonstrated with the HELP System. A brief discussion of a few of these clinical examples should be helpful.

ADVERSE DRUG EVENT MONITORING AND DETECTION

Clinical investigators at LDS Hospital have worked for over 2 decades on prevention of Adverse Drug Events [23-28]. Figure 2 shows a fishbone diagram of potential sources of Adverse Drug Events prepared by experts at LDS Hospital [25]. There are 5 primary causal reasons for ADEs and 43 different steps that may cause an ADE. Beginning in 1976 we used computers to detect drug-drug and drug-laboratory interactions [23]. Since that time, extensive and pro-active work have been done to identify and minimize ADEs at LDS Hospital. As a result of this work, it has become clear that ADEs are expensive, costing about $2,000 per ADE, cause about 2 days increase in length of hospital stay and, for persons having an ADE, there is about a 3 times greater chance of dying than if they did not have an ADE [26-28]. These studies further show that the number and severity of ADEs can be minimized by using the computer system to be proactive in preventing and more promptly treating ADEs.

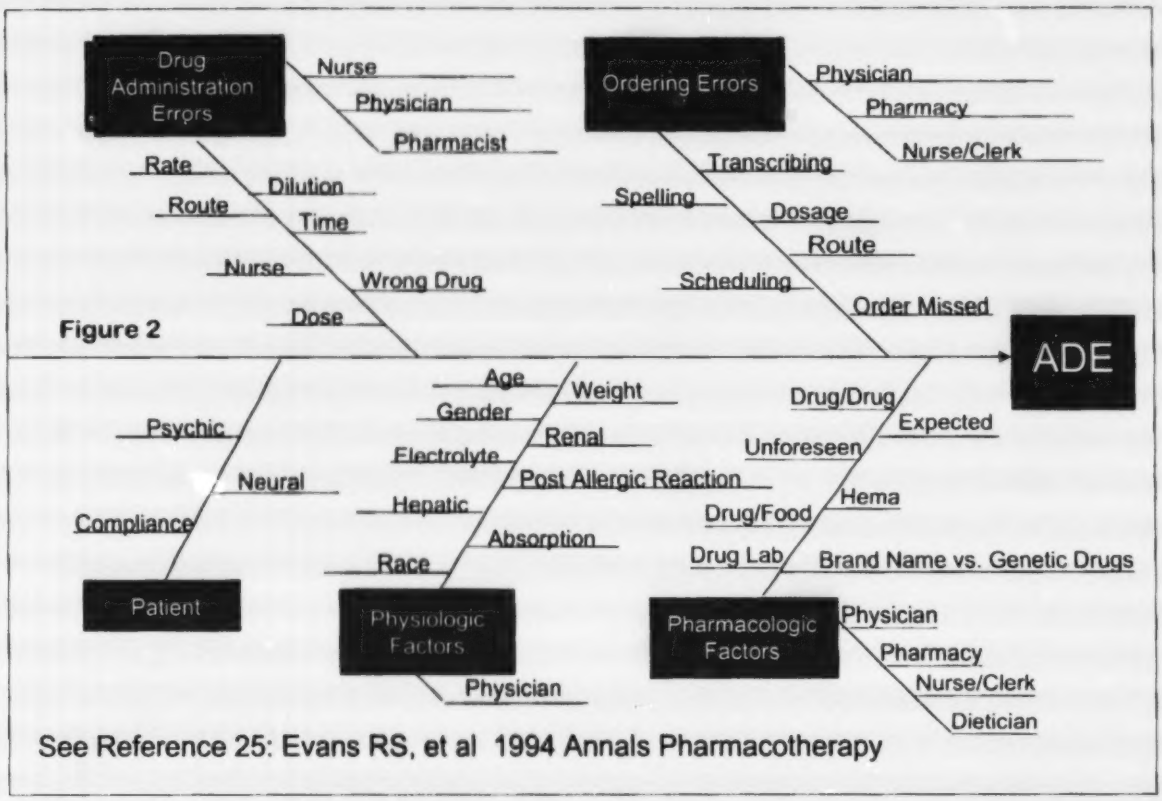

Figure 2: Fishbone Diagram of the Potential Causes of Adverse Drug Events (ADE). Adapted from [25].

INFECTION CONTROL AND ANTIBIOTIC USE

Making optimal decisions about which antibiotic to use requires access to a broad base of information. Although antibiotics may be miracle drugs, inappropriate use can lead to increased morbidity and mortality, development of resistant organisms, increased hospital cost, and adverse drug events. For over two decades at LDS Hospital a team of clinicians and medical informaticists have developed several important computer applications to minimize infections and optimize antibiotics prescribing [29-34]. These applications have included a method for reminding clinical staff to give antibiotics for selected surgical patients in a 2 hour time window before surgery [29]. As a consequence of giving antibiotics during that time window, surgical wound infections have been minimized. Using computer reminders, the compliance rate for giving antibiotics increased from near 60% to 99%. Missing a prophylactic antibiotic administration for a surgical patient who "needs" the antibiotic can be considered an error. Since surgical wound infections have a 6 times increase in mortality and a length of stay increase of 5.3 days and an additional cost of about $5,000 the application is highly used and very effective [27,32].

More recently a computerized "antibiotic assistant" program has been developed and evaluated [33]. The program provides clinicians with a wide variety of information from the patient's clinical record. Data such as maximum temperature, renal function, current antibiotics prescribed, microbiological findings and sensitivities as well as epidemiological data are promptly presented to clinicians on one computer screen. In addition recommended antibiotics with recommended dose, route, interval and duration are presented on the same screen. The "antibiotic assistant" has been very successful. While it takes an infectious disease expert 14 minutes using

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manual data review and information retrieval methods, the computer presents the data in only 3.5 seconds. Evaluation of the system showed that antibiotic allergies decreased from 13% to 6% when the computer was used. The computerized record contains the patient's antibiotic allergies and recommends no antibiotic to which the patient is allergic. Adverse drug events decreased from 36% to 16% when using the system. Mismatches of microbiological laboratory susceptibilities decreased from 15% to 2%. Since the computerized record contains the microbiology findings as well as susceptibilities, the computer can easily recommend the most effective antibiotic based on the known susceptibilities. Since the computer makes recommendations about the duration the antibiotic should be given, excess time on antibiotics was decreased from 5.9 to 2.7 days. Finally, antibiotics costs decreased by about 40%. Thus this program not only prevents errors, but also optimizes patient care.

OTHER "SMART" COMPUTERIZED METHODS

In addition to the applications described above, other methods have been developed to optimize patient care and prevent errors. Computerized laboratory alerting provides prompt and efficient notification to clinical staff via digital pagers when life threatening alerts occur [35]. As a consequence, patients are treated more promptly and appropriately. Computerized recommendations and monitoring of transfusion therapy has resulted in less use of blood products and giving these products for only appropriate reasons [36]. Computerization of ventilator management of critically ill patients with Adult Respiratory Distress Syndrome (ARDS) has lead to more optimal care and has decreased mortality by 25% [37]. Recent development of computerized methods to detect pneumonia in the emergency room and provide optimized care recommendations are showing promise [38].

All of the above methods are highly dependent on a collaborative relationship of physicians, nurse, therapists and other care givers. The computerized record and the medical decision-support features of the HELP system require that computerized data be entered promptly, accurately and completely. Thus the computerized record can be the "sharing point" of the collaborative effort of patient care.

WHAT ARE THE CURRENT ISSUES THAT PREVENT FURTHER USE OF COMPUTER TECHNOLOGY?

It is clear from the experience at LDS Hospital and a handful of other hospitals in the United States, that computers and computerized decision-support systems can not only help minimize errors but can also improve patient care [39]. If computerized systems can help prevent errors and augment the care process the next obvious question is why aren't they used everywhere. Medical informatics specialists the world over have explored these issues for over a decade. In June 2000 the National Committee on Vital and Health Statistics (NCVHS) issued a report on the topic entitled "Toward a National Health Information Infrastructure" [40]. This carefully crafted report is based on a review of the literature and obtaining testimony from experts in the field. A key section of the report is "What stands between the present and the desired future?" Surprisingly, technology does not seem to be the major deterrent. Most of the barriers are legal, societal, organizational and cultural in nature. The 10 factors listed by the NCVHS are:

1. Privacy protection - The most important immediate barrier is lack of comprehensive privacy protection for personal health information. Although the Health Insurance Portability and Accountability Act (HIPAA) of 1996 gave the Congress the opportunity to craft legislation by 1999, such legislation was not forthcoming. The HIPAA legislation then delegated establishment of privacy regulations to the Department of Health and Human Services. Although draft regulations are now available, comprehensive Federal legislation is needed.

2. Information as both a private resource and for public good - As a society, we must come to better understand how sharing of health information can improve not only our own health, but also lead to improved community health. Educating the public and coming to consensus among consumers, patients, health care providers and community health care officials is required.

3. Standards - For information in multiple locations to be shared, searched, and synthesized we need reliable and valid data collection methods; common vocabularies for personal, clinical, and public health information; compatible systems to manage, transmit and protect the confidentiality of the information; and standards for interoperability of these system.

4. Quality standards for online information - Since health information is much more than medical care data, the lack of quality standards for online consumer/patient information is still a major barrier to the needed infrastructure.

5. Technology - Security technology must be implemented to be certain that personal and other health information can be transmitted over the Internet and other public communications media.

6. Costs - Development of such systems and infrastructure is expensive and will likely take a public/private partnership to accomplish.

7. Attitudes and practices - Societal and professional attitudes toward sharing of data and use of practice guidelines must occur. To achieve the maximum benefit from the information infrastructure, clinical records must be shared among health care providers and with public health officials. Demonstration of the benefits of such sharing will help accelerate changes in current attitudes and practices.

8. Equity - The full potential of the use of computerized methods will maximized when all people without regard to income level, racial or ethnic background can have equal access and capability.

Dr. William W. Stead, Associate Vice-Chancellor for Health Affairs at Vanderbilt University Medical Center has a slightly different view point [41]. In a provocative article written in 1998 he projected how information technology might be used in a networked consumer-centered health care enterprise in 2008. He felt that the barriers to the promise of using information technology to improve health care at reduced cost would be:

1. Professional guilds - He feels that since each "professional guild" (physicians, nurse, pharmacists, etc) currently defines the knowledge required and curriculum for its guild, that there is a barrier to an effective health care system. He suggests that information technology and informatics can transform the information explosion from a problem to a rich resource. The topic bears directly on the purpose of this conference!!

2. Cross-subsidies - Dr. Stead contends that much of the cost of educating health care professionals is subsidized by funding from clinical services. As a consequence of this subsidy, there is little incentive to use information technology to reduce the cost and improve the quality of medical education.

3. Record ownership and confidentiality - In 1998 the health enterprise treats information as if it belongs to only the enterprise. As noted in the NCVHS report, health information must be shared across institutions and with the patient and confidentiality must be maintained.

As illustrated above, clinical information systems have a powerful potential to improve health care at reduced cost. Although there are several success stories about system development and installation there are also many failures. Heeks and colleagues from the University of Manchester in the United Kingdom provide some thought provoking evidence as to why there are failures in installing such systems [42,43]. They characterized failures into four forms: a) Total failure - where a new system is never implemented or where a system is implemented and immediately abandoned; b) Partial failure -where major goals are unattained or in which there are important undesirable outcomes; c) Sustainability failure - when an initiative initially succeeds but then fails after a year or so; and d) Replication failure - when an initiative succeeds in its pilot location but cannot be repeated elsewhere.

All of these failure modes tend to thwart the positive potentials of information systems. These investigators sought to understand why there were failures and studied several system installations. Based on these studies they created a "model" which focuses on the "gap" between what is "*concept*" and what is "*reality*." Having a "gap" that is as small as

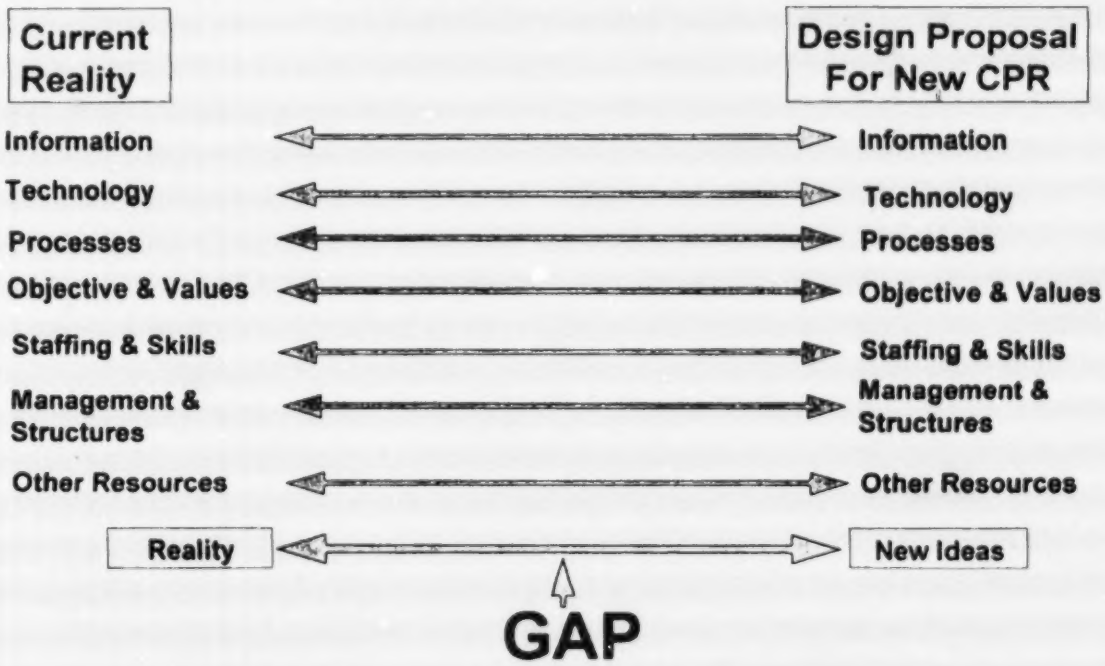
possible between *"reality"* and the proposed *"concept"* will have a higher probability of success. Answers to questions like the following and assessing the "gap" will be crucial in determining your success when you are installing a new system.

Figure 3 shows a graphical representation of the 7- element model., illustrating a method for assessing the gap between the current reality and the design proposal for a new computerized patient record system. The greater the gap in any one of the 7 elements, the greater the chance for failure.

Technology - Is the network communications infrastructure in place? Are sufficient personal computers or terminals available? Is the system fast enough? What system availability and reliability will be required? Can elements of the technology be upgraded easily? Will "wireless" networks be needed? Will privacy and security needs be met? Have all of the technological elements being used been integrated into one system before? Does the technology meet the expectations of the users?

Processes - Does the system fit into existing work processes? Will the system fit inpatient as well as outpatient needs? What sort or case mix will be served? How is the system to be funded? How is the system to be maintained and upgraded? Will the system be purchased or developed locally?

Figure 3: Managing Change for Computerized Patient Record (CPR) Implementation {University of Manchester, UK}



Information - What information is required to fulfil the needs of the new system? Is the needed information currently being collected? Is the system to provide only clinical or only administrative information or will both clinical and administrative data capture be required? Will the information acquired fit into a broad enterprise solution or is only a departmental solution required? Will the system meet regulatory requirements?

Objectives and Values - Is the system to be used to maximize profit? Is the system to be used to provide the highest quality care? What elements of the system will be most valued?

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Staffing and Skills - Is the staff properly trained? Have the staff "bought into" the strategies and objectives of the new system? Are there enough staff to get through the difficult start up periods? Does your clinical staff know how to navigate a Microsoft Window environment? Are there system "champions" and "cheerleaders" available? Can the technical staff support the installation?

Management and Structure - Is the system designed for a public or private care system? Is there administrative support for the tasks at hand? What will happen if there is a "failure" of one component of the system? Are communications mechanisms in place to optimize installation? How will the benefit of the system be made, by whom and when? Who will benefit most from the system?

Other Resources - How will the system be funded? How will the maintenance and upgrading of the system be accomplished? Must a training or educational objective be met?

Conclusion

Based on the information presented here it is clear that clinical computer systems can help prevent errors. More importantly computerized systems can provide even better care than current manual methods. Every effort should be made to use computerized system to prevent errors and improve communications and collaboration of all health care providers.

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Collaborative Education to Improve Public Safety – A Consumer Perspective

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Collaborative Education to Improve Public Safety – A Consumer Perspective

David Swankin, Esq.

Introduction

"*Putting the patient first*", "*empowering consumers*," "*a consumer-driven health marketplace*", and other similar words and phrases are commonplace in recent and current health policy debates taking place in legislative bodies, think tanks, radio talk shows, managed-care marketing materials, and just about everywhere else health issues are talked about. From a consumer perspective, the rhetoric could not be more welcomed.

While consumers and their advocates embrace the nearly universal acceptance of the concept that our health care delivery system ought to be redesigned and measured by how well it places patients first, there is a good amount of concern, and even skepticism, that the necessary reforms have taken place, or are now taking place to translate the stated goal into a reality.

Until recently, the debate over reforming the health care delivery system has been centered on the interplay among three principles: (1) the cost of healthcare; (2) its quality; and (3) its accessibility. Finding the right balance among these three are rightfully at the center of all the debates and discussions. But in November, 1999, with the publication of the watershed report of the Institute of Medicine, "To Err is Human", a fourth principle has been added, namely, the safety of our health care delivery system. Why should the safety issue be given such prominence, along with cost, quality, and access? Because no health delivery system that result in the death of between 44,000 and 98,000 citizens each year due to medical errors can claim to be a system that puts patients first. Overnight, the country became aware that more people die annually from medical errors than from automobile accidents. Proposals for remedial action to reduce the unacceptably high injury and death toll is already high on the agendas of the Executive branch of the U.S. Government, Congress, state legislators, and health care organizations around the country. From a consumer perspective, the question is this: when all the dust settles, will we have taken those steps necessary to significantly reduce the death and injury rates to more acceptable levels?

This paper addresses a single element that must be part of a medical errors reduction effort. That is, what can and should consumers expect from the educational system that trains the nation's future physicians, nurses, and other health professionals regarding learning to practice safely? More specifically, this paper addresses a single subset of the larger issue of appropriate training, namely, collaborative education to improve public safety. I have been asked to comment on this from a consumer perspective, and to discuss current barriers to collaborative education. I have also been asked to provide specific recommendations, from a consumer perspective, that might promote collaborative efforts to better ensure public safety.

What Does/Should the Public Know About How We Educate Physicians and Nurses?

The short answer is: **not much**. And that is both understandable and acceptable. We know little if anything about the educational preparation of pilots, lawyers, engineers, architects, ministers, or archaeologists, much less our health professionals. Nor do most people want to know, have a need to know, or would be particularly interested in learning.

What consumers do expect – **and have a right to expect** – is that the training and education given to the health professionals that will be working on their bodies and otherwise delivering their health care

services has indeed prepared these professionals to perform safely, effectively, and with high quality.

While this may be obvious, it is important to keep in mind, because it means that we should not and cannot count on consumers and consumer organizations to play a significant role in assuring the educational system is doing its job as well as it should. While consumers may well be positioned to bring about needed reform in managed care systems, they are not so positioned to play that role with regard to the educational system. That means the responsibility lies elsewhere, and that other institutions must take on the responsibility to assure the educational system is doing as well as it can and should do to assure safe practice by individual practitioners, and safe systems by the institutions in which they work.

Team Practice Requires Team Training and Education

In the past decade, numerous reports have been published addressing the issue of interdisciplinary education. The fact that team practice, or interdisciplinary practice is here to stay, and in fact becoming more and more characteristic of the way health care services are delivered, is a message that has been broadcast time and time again.

In 1994, the National Commission on Allied Health said:

"Emerging changes in health care will accelerate changes in educational programs...An increased emphasis on interdisciplinary practice will require that students, faculty, and clinical preceptors support and participates in the integration of interdisciplinary team experiences within the educational curriculum."[2]

The Pew Health Professions Commission (on which I had the privilege to serve), chaired by former Senator George Mitchell, made the following recommendation in its fourth and final report in 1998:

"RECOMMENDATION 1. Change professional training to meet the demands of the new health care system. In spite of the dramatic changes affecting every aspect of health care, most of the nation's educational programs remain oriented to prepare individuals for yesterday's health care system. They have not assimilated the new values, techniques, and skill sets required to pursue a thriving practice in the managed care world. Curricula for doctors, nurses, and allied health professionals must redirect their efforts to ensure that their graduates will be successful in the types of professional practice environments and organizations that are just emerging." [3]

The Commission also recommended that interdisciplinary competence be required in all health professions. We said:

"Today's best integrated health delivery systems are evolving toward a model of care in which interdisciplinary teams of providers manage the care of the sickest patients. This model, which involves physicians, nurses, and allied professionals, is proving its worth with both acutely and chronically ill patients... mistakes or duplication of services is avoided; and the expertise and instincts of a number of trained health practitioners are brought to bear in an environment that values brainstorming, consultation, and collaboration. This is not a value that has been indicated in health professional training programs of the past. Medical and professional schools should fundamentally reassess their curricula to ensure that their programs embody and apply an interdisciplinary vision." [emphasis added][4]

The Commission went on to say:

"Care delivery systems should work with local educational programs to describe and demonstrate how interdisciplinary skills are being incorporated into practice. Schools and faculties should target 25 percent of their current educational offerings that could more efficiently and effectively be offered in interdisciplinary settings." [emphasis added][5]

There are numerous other reports. In 1994 the Association of Academic Health Centers said in a book entitled "Health Workforce Issues for the 21st Century":

"The one way in which medical schools might entice more physicians to work in rural areas is to educate them with nurse practitioners and physician assistants to provide team health care. This type of experience should be a vital component of any medical (and nursinand physician assistant) education because

it makes the most sense for cost-effective provision of general health care."[6]

The call for more collaboration, more interdisciplinary education, and more preparation for teams practice is universal. In a report issued jointly by the Council on Social Work Education, The University of Southern California Department of Nursing, and others, the rationale is clearly spelled out:

"*Interprofessional education...gives students the opportunity to understand the knowledge, values objectives, ethics, and functions of other professions, in the belief that such understanding will promote effective collaboration in the workplace. Teaching methods...include case studies; real-life problem solving; participation in field work; site-based interdisciplinary teams; team teaching; student team seminars; use of families, parents, consumers, and agency staff as classroom teachers...*" [emphasis added][7]

All of the above-referenced studies and reports were issued prior to the publication of The Institute of Medicine's "Errors" report. At the time they were written, the main issues concerning everyone involved in health policy were finding ways to appropriately balance quality, cost, and access. The issue of safety was not on too many front burners. So one might ask, is the push to achieve more interdisciplinary education and training relative to, and important for building a safer health system?

The answer is clearly **yes**. The best way to prove that is to look to the IOM's "errors" report itself. Recommendation 8.1 calls on health care organizations to:

"*Establish interdisciplinary team training programs for providers that incorporate proven methods of team training, such as simulation.*"[8]

If one accepts that recommendation for health care organizations, then the academic community must come to accept its own responsibility to provide similar training and education programs when physicians, nurses and other health professionals are being educated. If we wait until health professionals are on the job to instill the value and teach the techniques of safety, then it will be too late.

The Quality Interagency Coordination Task Force (QuIC), established by the Clinton Administration immediately after the publication of the IOM errors report, clearly recognized the need for training and education. A number of their pledges contained in their February 2000 report to the President, indicate this understanding and commitment. For example, QuIC pledges to:

- "Develop and evaluate programs introducing health professionals to errors analysis and the challenges of practicing in a technically complex environment, [and] explore the use and testing of simulators and automation as educational tools...
- Provide technical assistance to State or professional agencies seeking to ensure a basic level of knowledge for health care providers on patient safety issues."[9]

Once again, as laudable as these pledges are, it will be too late to deliver this training for the first time only after health professionals have completed their education. Can anyone question the critical need for such training to begin in the schools?

Barriers to Interdisciplinary Education and Training

It is, of course, critical to acknowledge the need for interdisciplinary education and training while health professionals are in training. But more than recognition of the need is required. Recognition must lead to action.

History teaches us that it is not easy to bring about change in curriculum. In January 1995, the PEW Health Professions Commission's California Primary Care Consortium identified eight barriers often encountered in trying to organize an interdisciplinary educational experience as follows:

- finding room in the current curriculum.
- creating a trained interdisciplinary faculty.
- finding or establishing "role model" service settings.
- time commitment.
- logistics of matching maturity/experience levels of different student groups.
- lack of institutional recognition or reward for the process.

- Vested interests of established departments causing resistance to change.
- Separate educational facilities.

The PEW Consortium went on to offer ten strategies to overcome these barriers:

1) Agree on a unifying philosophy centered around primary care of the patient and the community.
2) Develop a commitment to the common goal of collaboration.
3) Learn about other professions.
4) Respect others' skills and knowledge.
5) Establish positive attitudes about one's own profession.
6) Develop trust.
7) Be willing to share responsibility.
8) Establish a mechanism for negotiation and re-negotiation of goals and roles.
9) Establish methods for resolving conflicts between team members.
10) Work to overcome barriers.

Many, including the PEW Health Professions Primary Care Consortium, and the National Commission on Allied Health, have also identified "turf battles" as a severe barrier. The PEW Consortium states that "these struggles over protecting the scope and authority of a profession involve issues of autonomy, accountability, and identity...The task of the collaborative enterprise is to identify and address these underlying factors that lead to territoriality."[11]

From a consumer perspective, if our health care system really is committed to the value of "putting patients first", then the barriers to collaborative education and training must be overcome. We need a driving force to bring about these changes. Since the driving forces is unlikely to be consumers themselves, or their advocacy organizations, then we must look elsewhere. Looking at all the institutional mechanisms that exist, the accreditation agencies seem to me to be ideally situated to force needed change. The question is: can they and will they take on that responsibility? Their past record is not particularly encouraging.

The Accreditation Process Has Been Flawed

In December, 1995, the Third Report of the Pew Health Professions Commission was harshly critical of accreditation, when they said:

"*Traditional accreditation serves as an impediment, real or imagined, to changing education, and it has out lived its current usefulness. It must be reinvented to serve the more pressing social need of making educational institutions truly responsive, or it must be simply discarded.*"[12]

The Council on Social Work Education, collaborating with the University of Southern California Department of Nursing, was equally blunt and critical:

"*Accreditation standards do not specifically address interprofessional education. The standards and curriculum policy statements neither encourage nor present specific barriers to interprofessional education and are largely silent about interprofessional education... Interprofessional practice suggests a predisposition to working in teams, but most professional preparation programs see their job as educating individuals.*"[13]

Still another report sponsored by the PEW Health Profession Commission, written by the Accreditation Task Force, called for massive reform of the accreditation system, and called for better linkages between the regulatory/licensing system and accreditation.

"*Linking Regulation and Accreditation. Because so many health professionals must graduate from an accredited program in order to sit for professional licensure, greater linkage between regulation and accreditation is an important issue. But whereas accreditation is a quasi-regulatory mechanism to evaluate educational programs, licensing evaluates individual competency. The two processes may be linked if both are focused on the same outcomes, such as competency-based performance assessment, but the fundamental emphasis - programmatic versus individual - remains different.*

Barriers to achieving greater integration are largely driven by the varying roles of regulation across the health professions and by the varying impact of licensure on professional practice.

Faculty and professionals often disagree on who should control curricula, so that for some professions the curricula do not

reflect the actual skills and knowledge needed for employment. In most professions, there is no coordination between the work of national accrediting agencies and the state licensing boards, despite their inter-dependence" [emphasis added][14]

From a consumer perspective, JCAHO and NCQA are positioned to require health care delivery institutions to develop and implement system safety programs. The Federal government can also bring pressure to bear on health care institutions through Medicare and Medicaid regulations, and by developing excellent "show and tell" example in its own agencies, such as The Department of Veterans Affairs. Federal and State legislative bodies can write laws imposing new requirements on hospitals and other institutions. But it is the educational institutions themselves, and their accreditors, that must step forward to instill safety awareness and know how in the next generations of physicians, nurses, and all other health professions.

Thirty eight years ago, President John F. Kennedy sent to Congress the very first message setting forth the rights of consumers. He identified four basic consumer rights, one of which was labeled the right to safety. Consumers have a right to be protected from preventable adverse events, whether caused by individuals, or by system errors, or by some combination of both. While consumers should not be expected to monitor the educational system, they should be able to rely on that system's ability to adequately prepare health care professionals to practice safely, in safe settings, and in safe systems. QuIC defines **error** as "the failure of a planned action to be completed as intended, or the use of a wrong plan to achieve an aim, and can include problems in practice, products, procedures and systems." QuIC defines **system** as "a regularly interacting or interdependent group of items forming a unified whole." Those key words "interacting" and "interdependent" are in one sense synonyms for the word "team practice", "collaborative practice," and "interdisciplinary practice." Clearly, if teaching health professions to act as part of a team is accomplished, it will be relatively easy to add the safety component to that training. But until and unless we overcome the barriers to interdisciplinary education and training, we won't succeed in teaching team safety. The challenge to the educational system is both moral and ethical, if not legal. Consumer have not only a desire, but a right to have educational institutions and their accreditors to step up to the plate and make it happen. It will be your shining hour if you do.

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The ongoing debate in the provision of health care. J Adv Nurs 28:1040-5.
Contrasts two models for roles of health professionals: 'care vs. cure'. Many associate the cure model with physicians and the care model with nursing and the other allied health professions. Shortcomings of a cure-orientated model have been noted, particularly with chronic disease, and more attention has been focused on care, with many writing as if these were mutually exclusive. The authors suggest that care and cure are end-points on a continuum which should be used by all health providers, rather than labeling different clinical professionals. This focuses on practical needs rather than what should be done by doctors vs. nurses. Converging professional roles does not imply that nursing and allied health professions will adopt a medical model, but that medicine, nursing and others will work together with patients for mutual benefit, focusing collaborative decision making on the patient and family.

9. Birnbaum, ML, Robinson, NE, Kuska, BM, Stone, HL, Fryback, DG, Rose, JH. (1994) Effect of advanced cardiac life-support training in rural, community hospitals. Crit Care Med 22:741-9.
Multidisciplinary training directed to the entire cardiac team favorably affected the overall practice and the survival rate of patients with ischemic heart disease in a community hospital.

10. Brita-Rossi, P. (1996). Improving the Process of Care: The Cost-Quality Value of Interdisciplinary Collaboration. Journal of Nursing Care Quality. 10(2):10-16.
A multidisciplinary group of clinicians and administrators examined all phases of care, noted innovative ways to contain costs and improve quality, and recommended changes on an inpatient orthopedic unit. Outlines changes related to preoperative, intraoperative, and postoperative care and discusses dynamics of effective interprofessional collaboration.

11. Burl, A., Rao, M., & Kahn, A.M. (1998). Geriatric nurse practitioners in long-term care: Demonstration of effectiveness in managed care. J Amer Geriatr Soc 46:506-510.
Outpatient clinics that employ interprofessional teams can document cost savings, improved health outcomes, and greater client satisfaction.

12. Burl, J.B., Bonner, A., Rao, M. (1994). Demonstration of the cost-effectiveness of a nurse practitioner/physician team in long-term care facilities. HMO Practitioner, 8:157-161.
Interprofessional practice models were effective in improving patient outcomes, increasing patient and provider satisfaction, and decreasing healthcare costs.

13. Campion, E. (1995). The value of geriatric interventions. New Engl J Med 332:1376-1378.
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14. Claflin, N. Interdisciplinary collaboration in the special care unit—Part I (1994) J Healthc Qual 16:23-5, 28-30.
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15. Coeling, H.V., Wilcox, J.R. (1994) Steps to collaboration. Nurs Adm Q 18:44-55.
Findings suggest that reliable presentation of relevant data, openness to information presented, and adequate time to communicate are necessary elements for collaboration . Differences were noted between nurses and physicians as to the relative importance of these behaviors.

16. Cohen, M.R., Anderson, R.W., Attilio, R.M., Green, L., Muller, R.J., Pruemer, J.M. Preventing medication errors in cancer chemotherapy (1996) Am J Health Syst Pharm 53:737-46.
Describes systems to prevent medication errors, with a key component being interdisciplinary teams at each practice site to review every medication error reported.

17. D'Avirro, J., Dotson, T., LaPierre, B., Marshall, W., Mishler, M. B., Tanger, J. L. An interdisciplinary clinical advancement program

within a patient- centered care model (1996) Rehabil Nurs 21:132-8.
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18. Dianas Hughes, N.P., & Routson, J.L. (1996). PICU Wellness and Renewal Project: A Multidisciplinary Group Process. Employee Assistance Quarterly, 12(1), 29-36.
Interprofessional practice is recognized as an important contributor to reduced hospital cost and improved inpatient outcomes including lowered mortality and increased patient satisfaction..

19. Dozier, A.M. Professional standards: linking care, competence, and quality (1998) J Nurs Care Qual 12:22-9.
Argues that professional standards are crucial as new practice settings are established, providing the infrastructure for developing standards of care, education programs, quality assurance programs, consistency across practice settings, and a basis for consensus building for interdisciplinary initiatives.

20. Fagin, C.M., (1992). Collaboration between nurses and physicians: no longer a choice. Nurs Health Care, 13:354-363; Acad Med 66:295-303.
Discusses collaboration, why there are compelling reasons to promote it, barriers between nurses and physicians in achieving collaborative relationships, and strategies to promote change. Besides structural issues, there is a historical bias, mistrust over autonomy and control, competition for income, and lack of understanding about each other's competency and professional roles. Presents comments of experienced observers and summaries of the pertinent research literature.

21. Fitzpatrick, J.J. (1998) Building community. Developing skills for interprofessional health professions education and relationship-centered care. J Nurse Midwifery 43:61-5.
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22. Fleming, C., Klein, D., Wilson, C. (1999) Forming collaborative relationships. Nurs Manage 30:38-9.
A Collaborative History and Physical form facilitated communication between nurses and physicians while it decreased duplication of data and increased patient satisfaction..

23. Frank, E., (1997). Enhancing patient outcomes: treatment adherence. J Clin Psych 58(suppl 1):11-14.
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24. Freeman, J.A., Hobart, J.C., Thompson, A.J. (1996). Outcomes-based research in neurorehabilitation: the need for multidisciplinary team involvement. Disabil Rehab 18:106-110.
Evaluation of neurorehabilitation needs to reflect the integrated multidisciplinary input since it is fundamental to the intervention process.

25. Grady, G.F., Wojner, A.W. (1996) Collaborative practice teams: the infrastructure of outcomes management. AACN Clin Issues 7:153-8.
Presents interdisciplinary outcomes management as a way to reduce costs and length of stay, improve outcomes, improve system processes, and foster outcomes research. Outcomes managers develop collaborative practice teams as vehicles of change through analysis of data and identification of best practices. Argues that shared responsibility for outcomes among disciplines and recognition of individual expertise in care can speed improvements in care.

26. Green, P.L. Improving clinical effectiveness in an integrated care delivery system (1998) J Health Qual 20:4-8.
Describes care management, "an interdisciplinary process of coordinating client-centered services across the continuum of care to achieve quality and cost-effective outcomes." A collaborative practice model drove improvement efforts, which significantly improved financial and clinical performance, prompting a leadership award from a nationwide alliance of community healthcare organizations.

27. Halm, M.A. (1997). Collaborative care: improving patient outcomes in cardiovascular surgery. Progr Cardiovasc Nurs 12:15-23.
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Examines perceptions of nurse-physician collaboration in a large county medical center emergency medicine (EM) residency program. There were significant differences between physicians and nurses in four collaboration measures (physician leadership, communication openness within and between groups, and group problem solving) and research use. Physicians had more positive views than nurses. Shows need to study nurse-physician differences in perceptions of collaboration and research use more fully.

29. Hartwig, M.S., Landis, B.J. (1999) The Arkansas AHEC model of community-oriented primary care Holist Nurs Pract 13:28-37.
Describes interdisciplinary community-based primary care, including a case study illustrating interdisciplinary and multidisciplinary approaches to managing patients with chronic illnesses.

30. Henneman, E.A., Lee, J.L., Cohen, J.I. (1995) Collaboration: a concept analysis J Adv Nurs 21:103-9.
Presents definitions and characteristics of collaboration to develop and evaluate tools for measuring collaboration. Models, contrary and related cases are offered to clarify concepts.

31. Herta, F., Fydrich, T, Turk, D. (1992). Efficacy of multidisciplinary pain treatment centers: a meta-analytic review. Pain, 49:221-30.
Interprofessional practice is recognized as an important contributor to reduced hospital cost and improved inpatient outcomes including lowered mortality and increased patient satisfaction.

32. Holm S., Gjersoe P., Grode G., Hartling O., Ibsen K.E., Marcussen H. (1996) Ethical reasoning in mixed nurse-physician groups. J Med Ethics 22:168-73.
Danish physicians and nurses do not differ in the kind of ethical reasoning they use, but physicians use more of the discussion time than nurses, a more assertive style of argumentation, and solutions chosen are usually first put forward by physicians.

33. Hutchens, G.C. (1994) Differentiated interdisciplinary practice. J Nurs Admin 24:52-58.
Studies show that differentiated nursing practice (DNP) improves outcomes for patients, practitioners, and healthcare organizations. Expanding DNP principles to an interdisciplinary model further improved access to health services, length of hospitalization, premature readmission, and self-care behaviors, as well as practitioners' role satisfaction and use of fellow team members in an oncology program.

34. Janson, L.K., Dudgeon, D., Nelson, F., Henteleff, P., Balneaves, L. (1997) Evaluation of an interdisciplinary training program in palliative care: addressing the needs of rural and northern communities. J Palliat Care 13:5-12.
Successful interdisciplinary training program in palliative care improved the quality of care to terminally ill cancer and AIDS patients in rural and northern communities in Manitoba.

35. Jones, RA. (1994) Conceptual development of nurse-physician collaboration. Holist Nurs Pract 8:1-11.

Presents two camps' views about nurse-physician collaboration. One supports nurse-physician collaboration using 4 indicators: (1) mutual power-control, (2) separate and combined practice spheres, (3) mutual concerns, and (4) common patient goals. The other describes a structure that must exist before collaboration can occur. Some literature supports both views in developing useful measures for collaboration to formulate recommendations for changes in delivery systems to effect outcomes.

36. Jones, RA. (1994) Nurse-physician collaboration: a descriptive study. Holist Nurs Pract 8:38-53.
Presents data to suggest that relationships of demographic variables to collaboration indicators can support development of profiles of nurses and physicians who may be less collaborative.

37. Knaus, W.A., Draper, E.A., Wagner, D.P., Zimmerman, J.E. (1986) An evaluation of outcome from intensive care in major medical centers. Ann Intern Med 104:410-418.
Interprofessional practice is recognized as an important contributor to reduced hospital cost and improved inpatient outcomes including lowered mortality and increased patient satisfaction..

38. Larson, E. (1999) The impact of physician-nurse interaction on patient care. Holist Nurs Pract 13:38-46.
Studies show that interdisciplinary collaboration improves outcomes, lowers costs, and increases provider and patient satisfaction. Barriers are structural (reimbursement, licensing, competition) and conceptual (lack of mutual role understanding, experience or training in collaboration). Perceptions of physicians and nurses vary as to the value of collaboration and joint decision making, what constitutes appropriate communication, the quality of interactions, and understanding of respective areas of responsibility and patient goals. These differences may relate to gender, historical origins of the professions, and physician-nurse socioeconomic, educational, and socialization disparities. Uncoordinated, negative physician-nurse interactions result in unhealthy work environments and poor patient outcomes. Both professions should examine their wills to improve interprofessional interactions.

39. Lassen, A.A., Fosbinder, D.M., Minton, S., Robins, M.M. (1997) Nurse/physician collaborative practice: Improving health care quality while decreasing cost. Nursing Econ 15:87-91,104.
Interprofessional practice models improve patient outcomes, increase patient and provider satisfaction, and decrease healthcare costs when employed in a variety of settings.

40. Le, C.T., Winter, T.D., Boyd, K.J., Ackerson, L., & Hurley, L.B. (1998). Experience with a managed care approach to HIV infection: effectiveness of an interdisciplinary team. Amer J Man Care, 4:647-657.
Interprofessional practice was effective in improving patient outcomes, increasing patient and provider satisfaction, and decreasing healthcare costs.

41. Liedtka, J.M., Whitten, E. (1998) Enhancing care delivery through cross-disciplinary collaboration: a case study. J Healthc Manag 43:185-205.
Using perceptual and objective performance data for physicians, nurses, and administrators, shared values, trust, and personal engagement correlated highly with perceived success of collaborative efforts in producing positive outcomes in care quality and efficiency, patient satisfaction, and improved work environment. Professional groups had differing views of the collaborative environment, raising key issues for managing collaborative efforts in hospitals.

42. Levison, S.P. (1996) Multidisciplinary women's health centers—a viable option? Int J Fertil Menopausal Stud 41:132-5.
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43. Lindeke, L,L., Block, D.E. (1998) Maintaining professional integrity in the midst of

interdisciplinary collaboration. Nurs Outlook 46:213-8.
Issues related to professional autonomy, communication.

44. Lofmark, R., Nilstun, T. (1997) Deciding not to resuscitate. Responsibilities of physicians and nurses— a proposal. Scand J Caring Sci 11:207-11.
Describes errors in which doctor commonly failed to take full responsibility for investigating conditions for do-not-resuscitate orders, make decisions, and inform patients and families. Physicians and nurses have different opinions about roles when DNR orders are initiated. Proposes a model which combines skills of physicians in defining diagnoses and prognoses and nurses in communicating with patients by virtue of their close relationships. Proposes that guidelines stress joint physician-nurse responsibility in investigating conditions for such orders, making decisions, and informing patients and families.

45. Lumpkins, R. (1995) Interdisciplinary collaboration strengthening documentation. Nurs Mgmt 26:48L-48P.
Describes a Quality Management Structure form that ensures performance improvement initiatives are interdisciplinary and fit organizations' missions by providing clear paths for performance improvement initiatives and fostering agreement on clinical outcomes, functional needs, satisfaction, and cost.

46. Makaram S (1995) Interprofessional cooperation. Med Educ 29(Suppl 1):65-9.
Reviews interprofessional cooperation and discusses its components and outcomes. Given historical nurse-doctor conflict, fashioning new interdisciplinary collaboration is a dynamic process, requires time, energy and commitment, demands interdependence, and is built on respect and understanding of unique, complementary perspectives that each profession makes to outcomes. Reviews elements of collaboration, advantages, barriers, impact of collaborative practice, and changes in practice patterns among various disciplines. Many universities and medical centers support faculty-practice joint appointment, believing that collaborative affiliation enhances educational and organizational goals. Problem-based learning curricula are permeating professional schools and facilitate learning of team collaboration. Favorable outcomes to collaborative practice outweigh the barriers.

47. Miller, S., King, T. (1998) Collaborative practice. A resource guide for midwives. J Nurse Midwifery 43:66-73.
Describes existing models of collaborative practice. Literature documenting the effectiveness of interdisciplinary teams of various health care providers and on the effectiveness of midwifery practice presents compelling arguments for midwife-physician collaborative practice.

48. Moran, S.K., Sicher, C.M. (1996) Interprofessional jousting and medical tragedies: strategies for enhancing professional relations. AANA J 64:521-4.
Studies of errors indicated dysfunctional nurse-physician relationships as potential contributing factors. Describes a workshop to enhance interprofessional relations offered at annual meetings, summarizes activities, and key lessons.

49. Payne, P.A., King, V.J. (1998) A model of nurse-midwife and family physician collaborative care in a combined academic and community setting. J Nurse Midwifery 43:19-26.
Certified nurse-midwives and family physicians share a philosophy of family-centered maternity care but seldom collaborate. Discusses advantages and barriers to collaboration for both types of practitioners and makes suggestions for successful collaboration.

50. Racine, A.D., Stein, R.E. K., Belamarich, P.F., Levine, E., Okun, A., Porder, K., Rosenfeld, J.L., Schechter, M. (1998) Upstairs downstairs: vertical integration of a pediatric service. Pediatrics, 102:91-97.
Interprofessional practice is recognized as an important contributor to reduced hospital cost and improved inpatient outcomes, including lowered mortality and increased patient satisfaction.

51. Ray, MD. (1998) Shared borders: achieving the goals of interdisciplinary patient care. Am J Health Syst Pharm 55:1369-74.
Presents components of interdisciplinary care, means of implementing, reasons for adopting, and barriers to it. Members of multidisciplinary clinical groups practice are aware and tolerant of other disciplines, actively coordinate care, make decisions by consensus, and have equal opportunities for input into decisions. To make a transition to interdisciplinary practice, all disciplines need common professional interests, values, vision, and knowledge base, increasing trust, and understanding of what each profession can contribute. Barriers include different philosophies of practice and training, logistics of team implementation, and resource limitations. Interdisciplinary care must be taught in professional schools and postgraduate training programs and applied cost-effectively.

52. Rodgers, J. Collaboration among health professionals. (1994) Nurs Stand 9:25-6.
Explores reasons for conflict between nurses, doctors and other staff despite the benefits to patients of health professionals working together harmoniously, and suggests remedies.

53. Ribby, K.J., Cox, K.R. (1997) Organization and development of a pediatric end stage renal disease teaching protocol for peritoneal dialysis. Ped Nurs 23:393-399.
Discusses development of an organized interdisciplinary approach for instruction and pediatric patient teaching protocol for management of home peritoneal dialysis therapy.

54. Rutan, G.H., Smith, R.G. (1997) Primary care within the VA: the firm model. Tenn Med 90:456-8. Reviews how VA medical centers are reorganizing total care across a continuum that includes outpatient, inpatient, long-term, and home based care, into interdisciplinary firms to improve access and continuity of care, improve housestaff education, and enhance research in primary care issues. Preliminary data show increased patient satisfaction and improved quality and efficiency. Suggests that this is a useful model for reorganization of care.

55. Ryan, J.W. (1999) Collaboration of the nurse practitioner and physician in long-term care. Lippincott's Prim Care Pract 3:127-34.
Collaboration between nurse practitioners and physicians in providing clinical care has positive effects for both clinicians and health care consumers, but collaboration does not occur automatically, needs to be learned, consciously approached, and protected. Critical attributes of successful collaboration and barriers to its implementation are discussed.

56. Schraeder, C., Britt, T., Dworak, D., Shelton, P. (1997) Management of nursing within a collaborative physician group practice. Semin Nurse Manag 5:133-8.
Describes a model of geriatric primary collaborative care between nurses and physicians that has been successfully implemented in a large primary care group practice setting.

57. Seignemartin, R.K. (1997) Multidisciplinary outcome indicators. J Intraven Nursing. 20:29-40.
Discusses how a multidisciplinary clinical pathway can be a tool to assist gathering of outcomes data. Demands of an informed public, managed care insurers, and the need to constantly improve patient care push providers to measure quality of outcomes. No one health care professional is the main contributor to patient outcomes, so indicators must be multidisciplinary.

58. Shindollar, J., Castillo, A., Buelow, J.M. (1995) Expansion of the seizure monitoring program. A collaborative approach. Nurs Clin North Am 30:53-60.
Interdisciplinary total quality management project.

59. Simpson, R.L. (1998) The role of technology in interdisciplinary practice. Nurs Manage 29:20-2.
Examines traditional differences between nurses and physicians and problems that they present, notes shared expertise and how managed care contributes to this overlap, and how evolving information systems support new synergies.

Nurses and physicians practice and think differently so that information systems they use are different.

60. Simpson, R.L. (1998) Bridging the nursing-physician gap: technology's role in interdisciplinary practice. Nurs Adm Q 22:87-90.
Strategies for managed care to bridge differences between nurses and physicians.

61. Solomon, M.Z., Guilfoy, V.H., Deutsch, C., Jackson, R., Koch-Weser, D., Nelson D., O'Donnell, L. (1988) Decisions near the end of life. J Contin Educ Health Prof 8:213-9.
Importance of developing interdisciplinary, action-oriented program on End-of-Life care.

62. Stichler, J.F. (1995). Professional interdependence: the art of collaboration. Adv Pract Nurs Quart 1:53-61.
Interprofessional practice models are effective in improving patient outcomes, increasing patient and provider satisfaction, and decreasing healthcare costs when used in a variety of settings.

63. Sweet, S.J., Norman, I.J. (1995) The nurse-doctor relationship: a selective literature review. J Adv Nurs 22:165-70.
Reviews research in clinical settings and applies sociological theory to the nurse-doctor relationship. Notes the 'doctor-nurse game', a stereotypical interaction pattern first described in the 1960s, in which (female) nurses learn to show initiative and offer advice, while appearing to defer passively to doctors' authority. This pattern is less common in clinical practice today but each profession still has ideal mutual expectations which inevitably fall short because doctors' and nurses' valuations differ.

64. Taylor-Seehafer, M. (1998). Point of view: nurse-physician collaboration. J Amer Acad Nurse Pract 10:387-381.
Reviews development of the primary-care team from the general practitioner's perspective —partners in the team, motives behind forming partnerships, and consequences for patient care.

65. Uden, G., Norberg, A., Lindseth, A., Marhaug, V.J. (1992) Ethical reasoning in nurses' and physicians' stories about care episodes. Adv Nurs 17:1028-34.
Nurses and physicians use different kinds of ethical reasoning, mainly because the professions have different tasks to accomplish and are trained in disciplines with different foci. Stresses the need to find a common frame story covering the two professional stories approaches.

66. Van Ess Coeling, H., Cukr, P.L. (2000) Communication styles that promote perceptions of collaboration, quality, and nurse satisfaction. J Nurs Care Qual 14:63-74.
Suggests teaching of communication styles to health care professionals to promote interdisciplinary collaboration as an essential element of quality health care. Failure to collaborate is usually due to a lack of collaboration skills. Notes the need for tangible, behaviorally specific ways to describe collaboration. Identifies effects of 3 specific communication styles, dominant, contentious, and attentive, on nurses' perceptions of collaboration, quality of care, or satisfaction with interactions.

67. Verschuren, P.J., Masselink, H. (1997) Role concepts and expectations of physicians and nurses in hospitals. Soc Sci Med 45:1135-8.
Role concepts and expectations of physicians and nurses must correspond if physicians-nurse collaborative practice is to improve quality of care. Nurses that did not work well with physicians had major differences from doctors in behavior concepts, roles, and job satisfaction. Negative effects on nurse-physician collaboration may adversely affect quality of care, outcomes, and nurses' job satisfaction. Role concepts of nurses in relation to their regular tasks, role behavior of physicians, especially in attending to patients' psychosocial needs, and nurses' expectations must be addressed.

68. Walker, P.H., Baldwin, D.W., Fitzpatrick, J.J., Ryan, S. (1998) Building community: developing skills for interprofessional health professions education and relationship-centered care. NLN

Appointed Interdisciplinary Health Education Panel.J Allied Health 27:173-8.
Recommendations for how to improve interprofessional collaborative relationships.

69. Watson, M.J. (1996). National League for Nursing Perspective, President's Message: From discipline specific to inter- to multi- to transdisciplinary health care education and practice. N&HC: Perspect Commun 17:90-91.
Barriers imposed by the lack of communication and shared objectives among disciplines.

70. Weinstein, M.E., McCormack, B., Brown, M.E., Rosenthal, D.S. (1998) Build consensus and develop collaborative practice guidelines. Nurs Manage 29:48-52.
With differing treatment guidelines available from many sources, collaborating advanced practice nurses and physicians recognized the need for one clear, acceptable set. Survey results showed that clinicians incorporated almost all (91%) of the guidelines into practice.

71. Wells, N., Johnson, R., Salyer, S. (1998) Interdisciplinary collaboration. Clin Nurse Spec 12:161-8.
Study of interdisciplinary collaboration showing significant differences related to use of different strategies. Presence of a case manager without collaborative paths led to higher collaboration levels. Perceived high physician involvement also was related to greater collaboration than perceived low involvement, with differences increasing over time.

Annotated Bibliography:

Interdisciplinary (Interprofessional) Education

1. Alexander, J., Smith, L., Hogston, R. (1998) Shared learning for community based maternity care. Nurse Educ Today 18:429-32.
Outlines current initiatives in British interprofessional education are based on assumptions that shared teaching and learning for midwifery and medical students or doctors should be the norm. Such major changes would require political will and public funding shifts, but this may be developing.

2. American Association of Colleges of Nursing (1995). Position Statement: Interdisciplinary Education and Practice. Washington, DC: American Association of Colleges of Nursing.
Emphasizes need for interdisciplinary education to develop and enhance collaboration. Cites barriers from lack of communication or shared objectives. Most studies of such programs are of single-sites, have few controls, short follow-up, low numbers of participants, without assessment of outcomes or costs. Requirements include long-term planning, resolution of structural and organizational barriers, outcome evaluation with model design modification, and commitment of substantial resources.

3. Atkins, J.M., Walsh, RS. (1997) Developing shared learning in multiprofessional health care education: for whose benefit? Nurse Educ Today 17:319-24.
Reviews literature summarizing threats and opportunities in multiprofessional education. Suggests respecting professional autonomy by not pushing collaboration too hard, allowing self-selected interactive learning. Suggests fostering nurses' organizational skills with stakeholders and extending best learning practices in joint multiprofessional programs to benefit consumers and administrators.

4. Baker, G.R., Gelmon S., Headrick, L., Knapp, M., Norman, L., Quinn, D., Neuhauser, D. (1998) Collaborating for improvement in health professions education. Qual Manag Health Care 6:1-11.
Identifies lessons from an Interdisciplinary Professional Education Collaborative in overcoming barriers to carrying out and institutionalizing continual improvement and interprofessional education.

5. Baldwin, D.C. (1998) The Case for Interdisciplinary Education. In Rubin, E.R. (ed.) Mission Management: A New Synthesis, vol. 2. Washington, D.C.: Association of Academic Health Centers. Briefly traces history and current status of interdisciplinary health professions education, argues for expanded interdisciplinary efforts, and suggests how academic health centers can support such them.

6. Balestreire, J.J., Gerrity, P., Geller, A., Gordon, P.R., Kundrat, M., Smithyman, K., Zimmero, B.S. (1998) Teams in a community setting: the AUHS experience Qual Manag Health Care 6:31-7.
Experience of one of several successful, if limited, programs in interdisciplinary education focused on continuous quality improvement, including a discussion of barriers, limitations, and successes.

7. Beauchesne, M.A., Meservey, P.M. (1999) An interdisciplinary community-based educational model J Prof Nurs 15:38-43.
Describes novel partnership to meet needs of the underserved combining service, education, and research with faculty in academic neighborhood health centers. Students assess, plan care, and treat patients and families in a community-based rather than large teaching hospital model. Reviews socialization of advanced nursing

students, interdisciplinary educational and service outcomes.

8. Behringer B.A., Bishop, W.S., Edwards, J.B., Franks, R.D. (1999) A Model for Partnerships Among Communities, Disciplines, and Institutions, in Holmes D, Osterweis M, eds. Catalysts in Inter-disciplinary Education: Innovation by Academic Health Centers, AHC Publ., Washington, DC, 43-58.
A rural community-based program required conflict management consultants to overcome faculty resistance. Benefited from a flexible faculty reward system. Differences in disciplinary language, accreditation requirements, and bureaucratic rules all had to be overcome, but 9 courses were developed. Close community partnership provided ongoing support. Expanded to include medical residents. Visionary leadership, communication skills, and community partners were keys to success.

9. Bellack, J.P., Gerrity, P., Moore, S.M., Novotny, J., Quinn, D., Norman, L., & Harper, D.C. (1997). Taking aim at interdisciplinary education for continuous improvement in health care. Nursing and Health Care Perspectives, 18:308-315.
Barriers include differences in definitions, student ages, academic preparation, gender, class, costs, ways to introduce students to patient care, student-faculty attitudes, scheduling, and infrastructure costs for interprofessional curricula. Success requires long-term planning, resolution of differences, ongoing outcome evaluation and design modification, and substantial resource commitment.

10. Betz, C.L., Raynor, O., Turman, J., Jr. (1998) Use of an interdisciplinary team for clinical instruction Nurse Educ 23:32-7.
Describes use of a clinical team to teach interdisciplinary skills of consultation and collaboration to foster an interdisciplinary approach to diagnosis and intervention planning.

11. Bowles, L., Jones, H. M. (1999) Experienced nurses learning with medical students: a case study Nurse Educ Today 19:263-8.
Shows that interprofessional education can overcome mismatch of clinical expertise, maturity and scientific background. Benefits included better understanding of the knowledge underpinning practice, anticipation of patients' needs, continuity of care, and education of patients and relatives, earlier recognition of complications and initiation of action, mutual understanding and appreciation of systems.

12. Bulger, R. J. (1995). Generalism and the need for health professional educational reform. Acad Med 70(Suppl 1), S31-34.
Academic centers are being pushed to adjust curricula to new realities but reform is blocked by fragmented health professions communities, turf issues, inflexible structures, shortfalls of education funds, and devaluation of teaching prevent responses to a changing environment. Universities should develop regional academic and community health center networks, commit to interdisciplinary team approaches in patient-centered systems, and create a student-centered value system.

13. Bulger, R.J., Bulger, R.E., (1990). Obstacles to Collegiality in the Academic Health Center. Bull NY Acad Med 68:303-307.
Separation of health science centers from parent universities, medical schools' roles in technology transfer, and growing importance of social sciences and new biomedical sciences to medicine all affect collegiality adversely. Barriers to interprofessional education arise from lack of consensus over the need for and how to implement programs, reimbursement, licensing, competition, lack of mutual role understanding and experience or training in interdisciplinary collaboration, control issues, differing goals and priorities, differing student characteristics, scheduling, and accreditation requirements. The key challenge is to create a sense of community and shared core values while building on progress.

14. Burns C., Smith A., Hyer K., Jacobson H., Lowry L., Reed C., Westhof W. (2000) Training the interdisciplinary team in primary care. National Academies of Practice Forum, 2. University of South Florida, Tampa,

Florida.Successful program in rural primary care dealt with barriers which included differences in student backgrounds, scheduling conflicts between schools, variation in student experience, and rigid, overly full pre-existing curricula.

15. Carpenter, J. (1995) Interprofessional education for medical and nursing students: evaluation of a program. Med Educ 29:265-72.
Describes interprofessional education program for 4th-year medical undergraduate BSc nursing students based on social psychology intergroup behavior studies. Included chances to work as equals in small collaborative groups on shared tasks. Attitudes towards the other profession improved, with better mutual understanding of knowledge, skills, roles, and duties.

16. Caswell D., Cryer H.G. (1995) Case study: when the nurse and physician don't agree. J Cardiovasc Nurs 9:30-42.
Though values are similar, frames of reference for value systems and perspectives of nurses and doctors differ. Understanding can alleviate stress and frustration when issues arise in clinical settings.

17. Chessman, A., Bellack, J.P., Cleghorn, G.D., Kennedy, D.B., Lahoz, M.R., Slaughter, S.C., Mahler, W.N. (1996) Institutionalizing continuous improvement in South Carolina: taking it "Bird by bird." Jt Comm J Qual Impr 22:177-187.
Describes the South Carolina Local Interdisciplinary Team's (LIT) goal of team learning and continuous health care improvement, how it worked to achieve goals, and lessons learned.

18. Clark, P. G. (1997) Values in health care professional socialization: implications for geriatric education in interdisciplinary teamwork. Gerontologist 37:441-51.
Presents model for understanding socialization into roles and norms and development of identity and practice patterns of physicians, nurses, and social workers, based on acquisition of values intrinsic to education and training. Discusses implications for abilities of different professions to collaborate. Uses model as a framework to develop new interdisciplinary curricular models in gerontological education.

19. Coleman, M.T., Headrick, L.A., Langley, AE., Thomas, J.X., Jr. (1998) Teaching medical faculty how to apply continuous quality improvement to medical education. Jt Comm J Qual Improv 24:640-52.
Describes training of faculty for education in continuous quality improvement (CQI) in interdisciplinary education. Faculty reported significant application of CQI principles and methods after only one year.

20. Coles, C. (1995) Educating the health care team. Patient Educ Couns 26:239-44.
Argues that interdisciplinary education should start with new students, expand via newly qualified staff, be part of specialist training, continue throughout professional development, and requires a unified strategy for life-long professional education. Proposes principles for how to do it, and describes how collaborative practice was started through interdisciplinary surgery rounds.

21. Cope, D.W., Sherman, S., Robbins, A.S. (1996) Restructuring VA ambulatory care and medical education: the PACE model of primary care. Acad Med 71:761-71.
Describes the VA Pilot (Primary) Ambulatory Care and Education (PACE) program, which shifts the focus of care from inpatient to the outpatient setting and uses an interdisciplinary team approach. Emphasis is on a biopsychosocial approach to managed integrated primary care, stressing cost-effective comprehensive care, prevention, and health maintenance, with problem-based learning for undergraduate and graduate trainees from 11 disciplines, emphasizing shared training experiences.

22. Council on Graduate Medical Education (1999) Thirteenth Report: Physician Education for a Changing Health Care Environment.
Recommendations include curricula with experiences in integrated health care delivery systems, team approaches to patient care, and training that includes conflict resolution and teamwork.

23. Council on Graduate Medical Education. (1999). COGME physician workforce policies: Recent developments and remaining challenges in meeting national goal. US Department of Health and Human Services, Health Resources and Services Administration.Emphasizes need for interdisciplinary approach to education to assure that collaboration is enhanced.

24. Cranford, C.O., Lewis, Y.L., Wohleb, J.C., Ward, H.P. (1999) Developing the Interdisciplinary Education Network, in Holmes D, Osterweis M, eds. Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers, AHC Publications, Washington, DC, 103-116.
Interdisciplinary education developed from a partnership between an AHEC and community health centers. Strong campus support provided a central "Clinical Skills Center" as a teaching clinic, integrated courses in geriatrics, interactive web-based instruction, faculty development support, integrated public health affiliations, and a faculty task force to review program needs, and expansion.

25. Edwards, J.B., Stanton, P.E., Jr., Bishop, W.S. (1997) Interdisciplinarity: the story of a journey. N HC Perspect Community 18:116-7.
Recounts experiences in interdisciplinary teaching and practice evolving from a Kellogg Foundation Community Partnerships for Health Professions Education grant for community-based teaching of medical, nursing, and other health professions students. Offers no easy formulas for success, points out practical problems, and suggests that interdisciplinarity may pose more questions than it answers.

26. Edwards, J., Smith, P. (1998) Impact of interdisciplinary education in underserved areas: health professions collaboration in Tennessee. J Prof Nurs 14:144-9.
Outcomes of a community-based interdisciplinary health professions education project involving Colleges of Medicine, Nursing and Public & Allied Health, from 1990-98. Committed leadership, effective communication, and genuine community involvement were essential to success.

27. Eide, P. (1996) Rural interdisciplinary healthcare training in Hawaii: a cross-cultural project. Aust J Rural Health 4:165-70.
Describes project to educate nursing, medicine, and other students in an interdisciplinary team in rural settings. Exposing students to rural health care and opportunities for teamwork helps recruit healthcare workers who know the challenges and rewards of rural practice.

28. Erkel, E.A., Nivens, A.S.; Kennedy, D.E. (1995) Intensive immersion of nursing students in rural interdisciplinary care. J Nurs Educ 34:359-65.
This interdisciplinary team approach to rural care serving culturally and geographically diverse groups positive influenced students' attitudes toward rural, interdisciplinary, community-based practice.

29. Felten, S., Cady, N., Metzler, M.H., Burton, S. (1997) Nurs Case Manag 2:122-6.
Describes how interdisciplinary teaching rounds on a university teaching hospital general surgery service improved communication and made patient care more efficient. Discusses impact of rounds on outcomes. Improved collaboration was key in implementing critical paths and case management.

30. Firpo, A. (1999) Tools for Effective Leadership in the 21st Century, in Holmes D, Osterweis M, eds. Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers, AHC Publications, Washington, DC, 117-136.
Keys to development of interdisciplinary education were: strong leadership, clear goals, willingness to seek and then commit resources; development of combined resources (computer information system, library, training center); a faculty planning group; fostering a sense of community and institutional (rather than separate school or departmental) culture via organizational changes and regular events.

31. Fitzpatrick, J.J. (1998) Building community. Developing skills for interprofessional health professions education and relationship-centered care J Nurse Midwifery 43:61-5.
Report of the National League for Nursing Panel on Interdisciplinary/Transdisciplinary Education, set up to examine educational issues that transcend the health professions, with recommendations for future implementation of an interdisciplinary approach to addressing them.

32. Foley, M., Jacobson, L., Anvaripour, P.L. (1995) Second-year medical students' perceptions of the professional nurse's role J N Y State Nurses Assoc 26:15-9.
At workshops to enhance nurse-physician collegiality, medical students had many misconceptions about nursing and the scope of nurses' roles in patient outcomes and welcomed opportunities to redefine these conceptions. Interdisciplinary collegiality deserve attention in medical school curricula.

33. Freeth, D., Nicol, M. (1998) Learning clinical skills: an interprofessional approach. Nurse Educ Today 18:455-61.
Innovative interprofessional acute care program for 4th year medical students and newly qualified nurses, using a patient scenario pertinent to participants' areas of practice. Each participatory learning session was led by an experienced nurse and doctor, supported by other specialists, stressing clinical and communication skills, with small interprofessional groups addressing a range of patient care issues. Participants and teachers were very positive and the program is expanding.

34. Fulginiti, V.A. (1999) The right issue at the right time, in Holmes D, Osterweis M, eds. Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers, AHC Publications, Washington, DC, 7-24.
Discusses crucial need to integrate unique contributions of diverse professions to provide effective patient care and requirements for cultural changes through education to reach that goal. Reviews the development of an interprofessional program starting with one course, utilization of community resources, and importance of leadership, resources and faculty development to breach barriers (scheduling, physical school locations, paucity of role models and leaders, inapt academic reward structures). Argues that rewards of successful development of interprofessional practice are high.

35. Fullmer T., Hyer K. (1998) Evaluating the effects of geriatric interdisciplinary team training. In E.L. Siegler, K. Hyer, T. Fullmer, M. Meazey (Eds.), Geriatric Interdisciplinary Team Training. New York, Springer, 115-146.
Outline program and outcome evaluation methods used in the John A. Hartford Interdisciplinary Geriatric Training Program.

36. Gariola, G. (1997). Developing rural interdisciplinary geriatrics teams in a changing health care environment. J Allied Health. 26:27-29.
Describes rural interdisciplinary training as a service delivery model for the elderly and discusses the role of interdisciplinary team training in an evolving care system. Students worked with physicians, nurses, and other workers as role models to motivate students toward rural practice.

37. Gelmon, S.B., (1996). Can educational accreditation drive interdisciplinary learning in the health professions? Joint Comm J Qual Improv 22:213-22.
Discusses role of accreditation in education; the potential of accreditation to stimulate continuous improvement in the health professions; and the potential for interdisciplinary curriculum development in health professions education and the challenges this poses for accreditation. Proposes a set of mock accreditation standards to guide evaluation of interdisciplinary health professions education.

38. Gelmon, S.B., Holland, B.A., Morris, B.A., Driscoll, A., Shinnamon, A.F. (1997) Health Professions Schools In Service To the Nation: 1996-1997.
Evaluation Report. Portland State University.
Report of the Health Professions Schools in Service to the Nation (HPSISN) program, created as a challenge to educational institutions to integrate service into study programs.

Discusses an evaluation plan designed to consider the program's effectiveness, presents 1996-1997 evaluation findings, and plans for subsequent evaluation (available at http://futurehealth.ucsf.edu/ccph/exsumm.html

39. Gordon, P.R., Carlson, L., Chessman, A., Kundrat, M.L., Morahan, P.S., Headrick, L.A. (1996) Interdisciplinary education in continuous improvement for health professions students. Acad Med 71:973-8.
The Institute for Healthcare Improvement (IHI) formed the Interdisciplinary Professional Education Collaborative (IPEC) to create interprofessional teaching and learning focused on improving health care delivery by stressing continuous improvement methods (CI) developed for manufacturing industries. Describes the 4 interdisciplinary teams in the first Collaborative and how they learned and practiced CI methods to make them more effective providers in a variety of health care systems.

40. Grant, R. (1995) Interdisciplinary collaborative teams in primary care: a model curriculum and resource guide. Pew Health Professions Commission, California Primary Care Consortium, California.
Delineates models to train and prepare students for interdisciplinary care, including reading, goals, exercises, cases, team exercises, and course scenarios (e.g., seminars, lectures, training modules).

41. Greenberg, R.S., Bellack, J.P. (1999) Building an Interdisciplinary Culture, in Holmes D, Osterweis M, eds. Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers, AHC Publications, Washington, DC, 59-78.
Early support from key administrators fostered innovation, planning, and curriculum development, allowing expanded interdisciplinary projects and overcame such major barriers as collection and apportionment of tuition revenues, fund allocation, and scheduling. Key lessons were needs to negotiate and use common definitions of "interdisciplinary;" integrate courses into curricula instead of adding electives; carefully select sites (community-based, not in hierarchy-bound academic centers); start students early; recognize good courses and programs, create faculty incentives; gain support of key leaders and keep them informed; share ideas; use space to enhance interaction; and evaluate.

42. Hamilton, C.B., Smith, C.A., Butters, J.M. (1997) Interdisciplinary student health teams: combining medical education and service in a rural community-based experience J Rural Health 13:320-8.
Only 21.2% of responding medical schools sponsored an interdisciplinary program, 76% of which were in rural communities, almost 2/3 in the South, with the lowest physician-to-population ratio. Cites value of programs in linking institutions' education missions and public service obligations.

43. Hansen, M. C., Hayes, P. A. (1998) Integrating students into interdisciplinary teams: extending the caring circle Semin Nurse Manag 6:214-8.
Describes specific strategies for developing interdisciplinary teams by emphasizing the building of relationships through shared knowledge, shared practices, and shared values.

44. Harman, L.B., Carlson, L., Darr, K., Harper, D., Horak, B.J., Cawley, J.F. (1996) Blessed are the flexible: the George Team. Jt Comm J Qual Improv 22:188-97.
Efforts of the George Washington University-George Mason University team from the Interdisciplinary Professional Education Collaborative produced intersecting groups: faculty, students, faculty/students and community sites, with faculty, clinical staff, and students. Commitment to change, caring for patients, and open communication were essential and increased understanding of the complexity and value of interdisciplinary education. Faculty provided guidance and support, students energized the process, and community sites made learning available to patients. Teaching and

learning continuous improvement was difficult but improved the educational process and clinical outcome.

45. Harman, P.J., Summers, L., King, T., Harman, T.F. (1998) Interdisciplinary teaching. A survey of CNM participation in medical education in the United States [published erratum appears in J Nurse Midwifery 1998 Mar-Apr;43(2):76]. J Nurse Midwifery 43:27-37.
Extent and characteristics of nurse-midwifery participation in medical education in the United States.

46. Harris, D.L., Stamaman, SM, Henry, RC, Bland, CJ. (1998). Multidisciplinary education outcomes of the W. K. Kellogg Community Partnerships and Health Professions Education Initiative. Acad Med 73:S13-S15.
The initiative sought to increase numbers of primary care providers and expanding multidisciplinary education. Requirements for interprofessional education include faculty development; collaboration with other health care disciplines to develop and evaluate interprofessional education models; common goals and clear communication among involved parties; and community and multicultural involvement.

47. Hayward, K.S., Powell, L.T., McRoberts, J. (1996) Changes in student perceptions of interdisciplinary practice in the rural setting. J Allied Health 25:315-27.
Significant change in students' perceptions of competence, autonomy, cooperation, and resource sharing within and across professions following an interdisciplinary rural clinical experience.

48. Headrick, L.A., Moore, S.M., Alemi, F., Hekelman, F., Kizys, N., Miller, D., Neuhauser, D. (1998) Using PDSA (Plan-Do-Study-Act) to establish academic-community partnerships: the Cleveland experience. Qual Manag Health Care 6:12-20.
Medicine and Nursing Schools created an interdisciplinary course in continuous improvement that emphasized experiential learning and created partnerships with area health care organizations. Respect for these partners as customers and serially refining relationships contributed to success.

49. Headrick, L.A., Neuhauser, D., Schwab, P., Stevens, D.P. (1995) Continuous quality improvement and the education of the generalist physician. Acad Med 70(Suppl):S104-9.
Lessons of an interdisciplinary education program stressing quality improvement include: (1) need for a "real work" context; (2) initial emphasis on "basics"; (3) focus on patient care; (4) interdisciplinary skills are essential and best learned during clinical training; and (5) a continuously improving setting produces optimism about for future generalists about the ability to make things better.

50. Headrick, L.A., Wilcock, P.M., Batalden, P.B. (1998) Interprofessional working and continuing medical education. BMJ 316:771-4.
History and progress report on a multisite collaborative for the development of interdisciplinary education in continuous improvement for health professions students.

51. Hewson, M.G., Fishleder, A.J., Halperin, A.K., Henry, C.A., Isaacson, J.H., Kachur, E., Tresolini, C. (1998)
Educating residents for managed care: report on a multidisciplinary conference. Acad Med 73:479-87.
Discusses need to train residents in interdisciplinary practice and recommendations on curricula, teaching methods, and attitudinal changes to prepare trainees to work in integrated care settings.

52. Hojat, M., Fields, S.K., Veloski, J.J., Griffiths, M., Cohen, M.J., Plumb, J.D. (1999)
Psychometric properties of an attitude scale measuring physician-nurse collaboration. Eval Health Prof 22:208-20.
Survey of attitudes to physician-nurse collaboration on areas of responsibility, expectations, shared learning, decision making, authority, and autonomy, measuring four underlying constructs of shared education and collaboration, caring as opposed to curing, nurse's autonomy, and physician authority.

Means were higher for 1st-year nursing than 1st-year medical students. Proposes use in evaluating program effectiveness in fostering collaboration and on differences in attitudes toward collaboration.

53. Hojat, M., Fields, S.K., Rattner, S.L., Griffiths, M. Cohen, M.J., & Plumb, J.D. (1997) Attitudes toward physician-nurse alliance: comparisons of medical and nursing students. Acad Med 72(Suppl 1), S1-3.
Notes differences in terminology, student ages, academic preparation, gender, class, socialization to patient care, costs, and attitudes.

54. Holmes D.E., Osterweis M. (1999) What is past is prologue: interdisciplinary education at the turn of the century. In Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers. Washington, D.C., Association of Academic Health Centers, 1-6.
Reviews status of interdisciplinary education, values of mutual learning of what other professions do, and correlations with positive outcomes for patients.

55. Horak, BJ, O'Leary, KC, Carlson, L. (1998) Preparing health care professionals for quality improvement: the George Washington University/George Mason University experience. Qual Manag Health Care 6:21-30.
Describes training program for medical, physician assistant, nurse practitioner, and management students in quality improvement, community-based primary care, and teamwork. Formed teams to apply knowledge in underserved areas ("service learning") under a community and faculty preceptor.

56. Hughes, L., Lucas, J. (1997). An evaluation of problem based learning in the multiprofessional education curriculum for the health professions. J Interprof Care. 11:77-88.
Positive student perception of problem-based curricula for multi-professional education.

57. Keenan, G.M., Cooke, R., Hillis, S,L. (1998) Norms and nurse management of conflicts: keys to understanding nurse-physician collaboration. Res Nurs Health 21:59-72.
Nurses' expectations for physicians to collaborate and strong constructive and aggressive norms explained a moderate amount of variance (32%) in nurses' intentions to collaborate vs. engage in conflicts. Proposes a theoretical framework to design ways to promote nurse-physician collaboration.

58. Kilo, C.M. (1999) Improving care through collaboration. Pediatrics 103(Suppl E):384-93.
Describes the Institute for Healthcare Improvement's Breakthrough Series, a collaborative model to bring health professionals together to accelerate improvement. Reviews lessons learned from it.

59. Kindig, D. (1975). Interdisciplinary Education for Primary Health Care Team Delivery. J Med Educ 50:97-110.
Classic summary of historical background of the primary health care team which addresses key questions about teams, reviews interdisciplinary education experiences for primary care, discusses educational guidelines, and proposes a model to implement concepts in a health sciences center.

60. Larson, E.L (1995). New rules for the game: interdisciplinary education for health professionals. Nursing Outlook 43:180-185.
Less than 15% of U.S. medical and nursing schools had any interdisciplinary programs. All but 1-2 offered only electives. Most were developed in response to community or institutional needs without outcomes evaluation. Even when perceived as successful, most interprofessional education programs depend on limited funding (usually grants) and are rarely integrated into curricula or institutionalized. Discusses new collaborative roles for nurses and contrasts with traditional attitudes and past examples of nursing roles following of physicians' orders, even if they were in error.

61. Lilley, S.H., Clay, M., Greer, A., Harris, J., Cummings, H.D. (1998) Interdisciplinary rural health training for health professional students: strategies for curriculum design. J Allied Health 27:208-12.
Presents 10 strategies for design and implementation of a interdisciplinary rural health

training curriculum. Suggests building on strengths of examining existing curricula and exploring new models.

62. Lough M.A., Schmidt K., Swain G.R., Naughton T.M., Leshan L.A., Blackburn J.A., Mancuso P.J. (1996) An interdisciplinary educational model for health professions students in a family practice center. Nurse Educ 21:27-31.
Describes an interdisciplinary education program for nursing, medicine, and social work students.

63. Low, M.D., Booker, J., Brannon, L. (1999) Embracing the barriers: an emerging model, in Holmes D, Osterweis M, eds. Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers, AHC Publications, Washington, DC, 137-166 (http://www.uth.tmc.edu).
Program began with strategic planning that recognized a need for change and steady top administrative support. Involves multiple schools and programs, course integration into curricula, ongoing planning and evaluation by 9 interdisciplinary teams: communications-marketing, content-curriculum, technology support-enhancement, organizational infrastructure-financing, faculty, student, affiliated-training sites, evaluation, synthesis (coordinating teams, results, communication). Lessons include needs to develop group process; develop faculty, student, community, and financial support for each project; strengthen commitment from administrative leaders; clarify expectations; develop key partnerships.

64. Lyons, J., Miller, M., Milton, J. (1998) Learning with technology: use of case-based physical and computer simulations in professional education. Contemp Nurse 7:35-9.
Interdisciplinary project consisting of a multi-media, computer-assisted pregnancy model to enhance assessment skills. Discusses educational issues, problems, steps to address them, learning outcomes for midwives, nurses and medical students, and how case simulations build competence. Also discusses how to evaluate technology-based projects and integrate them into curricula to aid learning.

65. Marcus, L.J., Dorn, B.C., Kritek, P.B., Miller, V.G., Wyatt, J.B. (1995) Renegotiating Health Care: Resolving Conflict to Build Collaboration. San Francisco: Jossey Bass.
Leading expert on negotiation and dispute resolution discusses origins of conflict and ways to promote interprofessional collaboration in this "bible" for health care negotiation. Includes chapters covering written by an M.D., a nurse administrator/educator), a social worker, an administrator and a "negotiation guru." Presents practical prescriptive interventions illustrated by practical examples.

66. Moore, S.M., Alemi, F., Headrick, L.A., Hekelman, F., Neuhauser, D., Novotny, J., Flowers, A.D. (1996) Using learning cycles to build an interdisciplinary curriculum in CI for health professions students in Cleveland. Jt Comm J Qual Improv 22:165-71.
Describes steps to improve an interdisciplinary education program focused on the teaching of continuous quality improvement.

67. Myths and opportunities: An examination of the impact of discipline-specific accreditation on interprofessional education – Executive Summary (1998) .
A report from: Preparing Human Service Workers for Interprofessional Practice: Accreditation Strategies for Effective Interprofessional Education. The Council on Social Work Education. Washington, DC, 1-25.

68. O'Neil, E.H. & Pew Health Professions Commission (1998).Recreating Health Professional Practice For A New Century. San Francisco, Ca: Pew Health Professions Commission.
Emphasizes the need for an interdisciplinary approach to education to assure that collaboration is enhanced in an integrated system for comprehensive health care.

69. Parsell, G., Bligh, J. (1999) Interprofessional learning [see comments] Postgrad Med J 74:89-95Comment in: Postgrad Med J 75:317-8.
Shifts toward primary care plus recent funding and organizational changes in the UK affect

work patterns and blur boundaries between professions' roles, knowledge, and skills. Effective care depends on awareness of needs to collaborate in and among community settings and hospital teams. Describes educational methods to aid understanding of complexities a multiprofessional healthcare environment and develop essential skills and attitudes. Institutions tend to avoid new methods which increase demands on dwindling resources. More studies are needed to show whether basic interprofessional education leads to better 'working together' in practice.

70. Parsell, G., Gibbs, T., Bligh, J. (1998) Three visual techniques to enhance interprofessional learning. Postgrad Med J 74:387-90.
Describes three group teaching methods to encourage high level collaboration and teamwork, using content from real-life healthcare issues, strong visual images to stimulate debate and discussion, learning objectives for each exercise, basic equipment and resources, and learning outcomes.

71. Parsell, G., Spalding, R., Bligh, J. (1998). Shared goals, shared learning: evaluation of a multiprofessional course for undergraduate students. Med Educ 32:304-311.
Describes a generally positive evaluation of a limited multiprofessional course.

72. Partnerships for Training (PFT) and Collaborative Interprofessional Team (CITE) Initiatives. (1999) Robert Wood Johnson Foundation. Http://www.rjw.org
Describes a new program for support of community-based interprofessional training.

73. Pearce, H., Blainey, D. (1999) Nurse mentors for preregistration. Hosp Med 60:127-8.
Describes the development of a popular, successful nurse mentorship scheme using the skills and expertise of senior nurses to help house officers through transition.

74. Reeves, S., Pryce, A. (1998). Emerging themes: an exploratory research project of an interprofessional education module for medical, dental and nursing students. Nurse Educ Today, 18:534-541.
Crucial needs include faculty development; collaboration to develop and evaluate new models; multi-cultural and community participation; shared goals; and clear communication among involved parties.

75. Report of the Task Force on Accreditation of Health Professions Education. (1999) Strategies for change and improvement. San Francisco, California: University of California San Francisco, Center for the Health Professions.
Includes suggestions for expansion of education to enhance interprofessional collaboration.

76. Ryan, A.A., McKenna, H.P. (1994) A comparative study of attitudes of nursing and medical students to aspects of patient care and the nurse's role in organizing that care. J Adv Nurs, 19:114-23.
Reviews important differences in students' attitudes and perceptions of roles and interactions.

77. Schaad, D.C., Crittenden, R.A., Mitchell, P.H. (1999) A partnership in interdisciplinary clinical education. Acad Med 74:586-7.
Describes a successful, limited interdisciplinary education program.

78. Singleton, J.K., Green-Hernandez, C. (1998). Interdisciplinary education and practice: has its time come? J Nurse Midwifery, 43:3-7.
Discusses barriers to and positive features of interdisciplinary education.

79. Smith, M., Barton, J., Baxter, J. (1996) An innovative interdisciplinary educational experience in field research. Nurse Educ 21:27-30.
Describes an interdisciplinary learning experience in field research for students and faculty members from schools of nursing and medicine.

80. Steele, S., Carruth, A. (1997) A comprehensive interdisciplinary chemotherapy teaching documentation flowsheet. Oncol Nurs Forum 24:907-11.

An interdisciplinary chemotherapy curriculum and documentation flowsheet improved collaboration while improving efficiency by eliminating duplication of work and reducing errors.

81. Sternas, K.A., O'Hare, P., Lehman, K., Milligan, R. (1999) Nursing and medical student teaming for service learning in partnership with the community: an emerging holistic model for interdisciplinary education and practice. Holist Nurs Pract 13:66-77.
Partnering of medical and nursing students with communities in health promotion education programs and activities as part of the Health Professions Schools in Service to the Nation Program.

82. Stubblefield, C., Houston, C., Haire-Joshu, D. (1994) Interactive use of models of health-related behavior to promote interdisciplinary collaboration. J Allied Health 23:237-43.
An interdisciplinary course fostered positive attitudes toward collaboration by stressing understanding of each discipline's roles in a team and respect for each discipline's input in decision-making.

83. Sturmberg, J.P., Overend, D. (1999). General practice based diabetes clinics. An integration model. Austral Fam Phys 28:240-245.
Interprofessional practice was effective in improving patient outcomes, increasing patient and provider satisfaction, and decreasing healthcare costs.

84. Swanson, E.A., Taylor, C.M., Valentine, A.M., McCarthy, A.M. (1998) The integrated health professions education program seminar. Nurse Educ 23:18-21.
Discusses a limited team-building seminar series with technology-based instruction and visits to community clinical sites in an Integrated Health Professions Program, designed to give students a common educational experience to foster collaborative work in underserved or rural settings.

85. Wendelberger, K., Simpson, D., Headrick, L. (1997) Building faculty skills as educators: a total quality management approach. Acad Med 72:464-5.
Describes experience applying principles of ongoing evaluation and quality improvement to education programs focused on teaching students and trainees principles of continuous quality improvement.

86. Wilcock, P.M., Headrick, L.A. (2000) Interprofessional learning for the improvement of health care: Why bother? J Interprof Care 14:111-17.
Reviews USA and UK interprofessional education efforts focused on training professionals together to reorganize service around patients' needs and utilize unique differing skills of different types of health professionals. Shows how such reorganization can improve the quality of care and reduce errors.

87. Williams P.C., Richmond, A.W., Edelman, N.H. (1999) Sharing a Common Core: Stony Brook's Program in Interprofessional Education, in Holmes D, Osterweis M, eds. Catalysts in Interdisciplinary Education: Innovation by Academic Health Centers, AHC Publications, Washington, DC, 79-102.
Resistance to interdisciplinary education was not overcome until top administrative leadership was supportive. Scheduling, grading, course credit, faculty rewards, changing leadership, differences over burden sharing, student recruitment, and rising clinical demands on faculty time were major barriers. Preliminary evaluations were positive. Unlike more community-based successful programs, courses were in an academic center, so potent departmental and disciplinary hierarchies were greater barriers.

88. Zungolo, E., (1994). Interdisciplinary education in primary care: the challenge. Nurs Health Care 15:288-292.
Barriers to interprofessional education result from a lack of consensus over the needs for programs, implementation, differing student characteristics, scheduling difficulties, accreditation requirements, disparities in resources and costs. Control issues and differing goals and priorities cause conflict.

Annotated Bibliography:
Medical Errors and Error Prevention

1. Alibhai, S.M.H., Han, RK, Naglie, G. (1999) Medication education of acutely hospitalized older patients. J Gen Intern Med 14:610-616.
Patients perceive the education they receive from physicians or pharmacists to be satisfactory but many still make errors when they take medications. Clinicians cite many barriers to providing adequate patient education about medicines, especially lack of time.

2. Ash, J.S., Gorman, P.N., Hersh, W.R., Lavelle, M., Poulsen, S.B. (1999) Perceptions of house officers who use physician order entry. Proc AMIA Symp 471-5.
House officers felt that a computerized physician order entry system helped patient care but hurt education. Underscores that new technology systems should be tailored to fit working conditions and perceived needs. Implementation plans should engage professional staff in the process.

3. Barthelemy-Brichant, N., Sabatier, J., Dewe, W., Albert, A., Deneufbourg, J.M. (1999) Evaluation of frequency and type of errors detected by a computerized record and verify system during radiation treatment. Radiother Oncol 53:149-54.
Describes how technology systems set up to reduce errors might actually increase them, emphasizing the need for "human factors design." This system could detect radiation treatment setting errors but repeated "automatic" errors could arise from erroneous parameter entries and undue user confidence.

4. Bates, D.W., Leape, L.L., Cullen, D.J., Laird, N., Petersen, L.A., Teich, J.M., Burdick, E., Hickey, M., Kleefield, S., Shea, B., Vander Vliet, M., Seger, D.L. (1998) Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. JAMA 15:1311-6.
Computerized physician order entry and team intervention decreased serious medication errors 55%.

5. Bates, D.W., Pappius, E.M., Kuperman, G.J., Sittig, D., Burstin, H., Fairchild, D., Brennan, T.A., Teich, J.M. (1998) Measuring and improving quality using information systems. Medinfo 9:814-8.
Describes a system that reduced unnecessary laboratory testing, rapidly reported key abnormalities to providers, detected and prevented adverse drug events, reduced prescription costs, and brought critical pathways to providers. It will next be used to promote widespread guideline use. Practical quality measurement must be integrated into care and preferably done using information systems to provide simultaneous measurement and decision support. Such systems enable larger scale implementation of improvement and cost reduction measures than was possible in the past.

6. Bates, D.W., Cullen, D. J., Laird, N., Petersen, L. A., Small, S. D., Servi, D., Laffel, G., Sweitzer, B. J., Shea, B. F., Hallisey, R., et al. (1995) Incidence of adverse drug events and potential adverse drug events: Implications for prevention. JAMA 274:29-34.
Study of admissions to medical and surgical intensive care units at two tertiary care hospitals showing that adverse drug events are common and, especially for serious events, often preventable. Most resulted from errors during ordering but many occurred during administration.

7. Bates, D.W. (2000) Using information technology to reduce rates of medication errors in hospitals. BMJ 320:788-91.
Reviews practical experience in how computerized physician order entry and decision support can improve patient safety. Discusses how other innovations (e.g., robots filling prescriptions, bar coding, automated dispensing devices, computerized administrative records, computerized linkage of all medical records) should further lower error rates in the future.

7. Battles, J.B., Kaplan, H.S., Van der Schaaf, T.W., Shea, C.E. (1998) The attributes of medical event-reporting systems: experience with a prototype medical event-reporting system for transfusion medicine. Arch Pathol Lab Med 122:231-8.
An event-reporting system incorporated into quality assurance and risk management efforts can help organizations deal with system procedural flaws where potential for errors can adversely affect outcomes. With suggestions incorporated from users and outside experts, this reporting system can provide a useful model for teams developing event-reporting systems in other areas.

8. Berry, K., Krizek, B. (2000) Root cause analysis in response to a "near miss". J Healthc Qual 22:16-8.
Describes changes in policy and procedures for patient-controlled analgesia therapy based on root cause analysis, a technique applied to sentinel events and "near misses" to define the real causes.

9. Block, F.E., Jr., Reynolds, K.M., McDonald, J.S. (1998) The Diatek Arkive "Organizer" patient information management system: experience at a university hospital. J Clin Monit Comput 14:89-94.
Describes how providers can sabotage new error prevention technologies if they are not consulted in design and implementation. Based on past attempts, a new computerized system was installed in operating rooms with hardly any discussion beforehand. Minor initial difficulties were promptly corrected, but continued opposition by key "leaders" plus obsolescence as new technology developed led to abandonment and removal of the system. "Improvements" require consultation with users, proper training, provision for evaluation, and flexible adaptation for practical, effective use.

10.Boling, P.A., Keenan, J.M. (1992) Communication between nurses and physicians in home care. Caring 11:26-9.
The increasing acuity of illness among home care patients and complexity of the in-home service network have created a greater need for frequent communication between the various members of the interdisciplinary home care team. This will become an increasingly important in quality-of-care and error prevention as home care expands and incorporates advances in technology.

11. Brennan, T.A., Leape, L.L., Laird, N.M., Hebert, L., Localio, A.R., Lawthers, A.G., Newhouse, J.P., Weiler, P.C., Hiatt, H.H. (1991) Incidence of adverse events and negligence in hospitalized patients: Results of the Harvard Medical Practice Study I. N Engl J Med 324:370-376.
Nearly 4% of patients hospitalized in acute care hospitals suffered an injury caused by treatment.

12. Bulger, R.J. (2000) The quest for the therapeutic organization. JAMA 283:2431-2433.
Discusses need to reorganize academic health centers for quality and safety enhancement based on patients' perspectives, emphasizing collaborative, interprofessional, evidence-based care.

13. Burlington, D.B. (1996) Human factors and the FDA's goals: improved medical device design. Biomed Instrum Technol 30:107-9.
Reviews the FDA's human factors design requirements for medical devices and how devices should be designed to ensure proper attention is paid to human error prevention. Stresses how critical it is to report use errors as they occur, emphasizes the need for manufacturers to create easy-to-use labeling and packaging, calls for simplicity and quality of medical product design, and asks for all health professionals to help implement FDA's human factors program.

14. Cadogan, M.P., Franzi, C., Osterweil, D., Hill, T. (1999) Barriers to effective communication in skilled nursing facilities: differences in perception between nurses and physicians. J Am Geriatr Soc 47:71-5.
Compares differing perceptions of communication barriers among nurses and physicians in nursing homes. Physicians but not nurses saw nursing competence as a barrier, nurses perceived physicians to be unpleasant, and both groups felt that physicians did not value nurses' opinions. Differences in awareness about scope of practice and regulatory requirements as well as differences in professional culture, social status, and gender inequality may explain discordant perceptions.

15. Casarett, D., Helms, C. (1999) Systems errors versus physicians' errors: finding the balance in medical education. Acad Med 74:19-22.
Discusses needs and strategies to balance the use of a systems approach and a personal-responsibility approach to managing errors in academic medical centers.

16. Christensen, C., Larson, J.R., Jr., Abbott, A., Ardolino, A., Franz, T., Pfeiffer, C. (2000) Decision making of clinical teams: communication patterns and diagnostic error. Med Decis Making 20:45-50.
Errors may arise if clinical decisions require consideration of uniquely held information. In simulated cases, teams' overreliance on previously shared information and inability to use information available to only single team members led to errors when correct diagnoses required inclusion of the latter.

17. Cimino, C. (1998) The dependence of educational infrastructure on clinical infrastructure. Proc AMIA Symp 462-6.
Students perceive a paradoxical declining support for computer use as they progress through school because of the discrepancy between computer infrastructure available to students and faculty on versus off campus. Clinical infrastructure may be growing at the expense of educational infrastructure, impairing implementation of effective systems use and error prevention efforts.

18. Classen, D.C., Pestotnik, S. L., Evans, R. S., Lloyd, J. F., Burke, J. P. (1997) Adverse drug events in hospitalized patients. JAMA 277:301-6.
Study found substantial increases in lengths of stay and hospitalization costs attributable to adverse drug events in hospitalized patients. Adverse drug events were associated with prolonged lengths of stay, increased economic burdens, and an almost doubled risk of death.

19. Cohen, M. (1999) Medication Errors. Washington DC: The American Pharmaceutical Association Foundation
Overview of types of medication errors, processes that lead to errors, research on medication errors, and suggestions for minimizing the potential for future errors.

20. Cook, R.I., Render, M., Woods, D.D. (2000) Gaps in the continuity of care and progress on patient safety. BMJ 320:791-4.
Accident analysis usually turns up many gaps between people and processes, but gaps only rarely lead to accidents. Safety is increased by understanding and aiding practitioners' abilities to handle gaps, but little is known about how gaps are identified and bridged when systems change.

21. Cullen, D.J., Bates, D.W., Small, S.D., Cooper, J.B., Nemeskal, A.R., Leape, L.L. (1995) The incident reporting system does not detect adverse drug events: A problem in quality assurance. Jt Com J Qual Improv 21:541-548.
Suggests that reliance on incident reports results in a drastic underestimate of the rates of events. Comparing yields of spontaneous reporting by an incident reporting system to intensive, confidential data collection by stimulated self-report and daily record review, 94% of adverse drug events that were discovered by record review and confidential report were not reported as incident reports.

22. Dianis NL; Cummings C. (1998) An interdisciplinary approach to process

performance improvement. J Nurs Care Qual 12:49-59.
Describes a Quality Management Structure that ensures performance improvement initiatives are interdisciplinary and foster agreement on clinical outcomes, functional needs, satisfaction, and cost.

23. Doing What Counts for Patient Safety: Federal Actions to Reduce medical Errors and Their Impact. (2000) The Quality Interagency Coordination Task Force (QuIC), Report to the President.
Summarizes data on medical errors and plans for a federal response, including over 100 recommendations for action (available at: http://www.ama-assn.org/med-sci/npsf/lit/rpt1099.htm).

24. Donchin, Y., Gopher, D., Olin, M., Badihi, Y., Biesky, M., Sprung, C.L., Pizov, R., Cotev, S. (1995) A look into the nature and causes of human errors in the intensive care unit. Crit Care Med 23:294-300.
In this ICU study, severe or potentially detrimental errors occurred twice a day. Physicians and nurses contributed equally to numbers of errors but nurses had many more daily activities. Many errors were due to communication problems between physicians and nurses. Applying human factor engineering concepts and interprofessional cooperation to the study of the weak points may help to reduce errors.

25. Evans, R.S., Pestotnick, S.L., Classen, D.C., Clemmer, T.P., Weaver, L.K., Orme, J.F., Lloyd, J.F., Burke, J.P. (1998) A computer-assisted management program for antibiotics and other antiinfective agents. New Engl J. Med 338:232-8.
How a computerized system for managing antiinfective drug use reduced drug dosing errors, adverse drug events, and mismatches with susceptibility data, lowered costs and length of hospital stay.

26. Feldman, S.E., Roblin, D.W. (1997) Medical accidents in hospital care: applications of failure analysis to hospital quality appraisal. Jt Comm J Qual Improv 23:567-80.
Medical accidents are not random events but can be understood in the context of latent system faults by applying failure analysis to patient injuries to detect system faults rather than seeking clinician errors. Analysis of causal factors in quality improvement can reduce iatrogenic injuries and adverse outcomes.

27. Friedman, L.H., White, D.B. (1999) What is quality, who wants it, and why? Managed Care Q. 7:40-46.
Discusses approach to organizational change by implementing quality management ideas, enhancing patient safety by empowering employees to identify issues that threaten quality and finding solutions.

28. Gardner, R. M., Christiansen, P. D., Tate, K. E., Laub, M. B., Holmes, S. R. (1993) Computerized continuous quality improvement methods used to optimize blood transfusions. Proc Annu Symp Comput Appl Med Care 166-70.
Describes use of a computer system to minimize overtransfusion and undertransfusions by prompting physicians when orders that did not meet accepted criteria were made.

29. Gardner, R.M., Prakash, O. (1994) Challenges and opportunities for computerizing the anesthesia record. J Clin Anesth 6:333-41.
Provides example of how providers and informatics professionals can devise practical joint solutions to technical, social, and educational issues and improve patient safety.

30. Gardner, R.M., Pryor, T.A., Warner, H.R. (1999) The HELP hospital information system: update 1998. Int J Med Inf 54:169-82.
Describes HELP, an integrated hospital information system providing services with clinical decision-support capabilities for a wide variety of clinical areas such as laboratory, nurse charting, radiology, pharmacy, etc. Evaluations show that computerized clinical decision-support is feasible, widely accepted by clinical staff, improves patient care and safety, and makes it more cost- effective.

31. Gosbee, J., Gardner-Bonneau, D. (1998) The human factor. Systems work better when designed for the people who use them. Healthc Inform 15:141-2, 144.
Describes the use of human factors design in creating systems that minimize error risks.

32. Grabowski, M., Roberts, K. (1996) Risk mitigation in large scale systems: lessons from high reliability organizations. Cal Manage Rev 39:152-162.
Organizations that minimize risk in complex environments stress good communication, organizational flexibility, empowering individuals and groups to act to promote safety, and attending to system interfaces.

33. Grant, S. (1999) Viewpoint: Who's to blame for tragic error? Am J Nurs 99:9.
Briefly recounts an institution's experience with a highly publicized chemotherapy administration error.

34. Haug, P.J., Gardner, R.M., Tate, K.E., Evans, R.S., East, T.D., Kuperman, G., Pryor, T.A., Huff, S.M., Warner, H.R. (1994) Decision support in medicine: examples from the HELP system. Comput Biomed Res 27:396-418.
Describes computer-directed interaction to aid physicians, nurses, and therapists in processes that respond to clinical data by issuing alerts denoting key data and its import; critiquing new orders and proposing appropriate changes; suggesting new orders and procedures in response to patient data; and summarizing patient care data and retrospectively assessing the average quality of decisions and therapeutic interventions. This computer HELP system improves quality of care and patient safety.

35. Heckman, M., Ajdari, S.Y., Esquivel, M., Chernof, B., Tamm, N., Landowski, L., Guterman, J.J. (1998) Quality improvement principles in practice: the reduction of umbilical cord blood errors in the labor and delivery suite. J Nurs Care Qual 12:47-54.
Education-based interventions failed to decrease error rates but an interdisciplinary working group of key stakeholders investigated, designed, and evaluated interventions for a system-based solution that effected substantial improvements. Success is attributed to interdisciplinary involvement, commitment by key stakeholders, and use of systems reengineering principles.

36. Heeks, R., Mundy, D., Salazar, A. (1999) Why health care information systems succeed or fail. In Information Systems for Public Sector Management Working Paper Series, Paper No. 9. Institute for Development Policy for Development Policy and Management, University of Manchester, UK, 1-25 (available at: http://www.man.ac.uk/idpm/idpm_dp.htm#isps_wp).
Useful, accepted information systems must arise from and fit into the behavioral realities of health care organizations. Following design, implementation may require multiple adjustments, as well as specific differences in adaptations to match distinctive realities in different institutions and health care settings.

37. Helmreich, R.L. (2000) On error management: lessons from aviation. BMJ 320:781-5.
Because accidents are highly visible, aviation has developed standardized methods to investigate, document, and spread information about errors and lessons learned from them. Observation of flights and simulations are used to define errors in compliance, communication, procedures, proficiency, and decision-making. Studies of surgery confirm similarities between doctors and pilots in interpersonal problem areas and professional culture. Medicine can learn much from aviation in accepting the inevitability of error and designing systematic methods to lower rates and severity of adverse events.

38. Kahneman, D., Slovic, P., Tversky, A., eds. (1982) Judgment Under Uncertainty: Heuristics and Biases. New York, NY: Cambridge University Press.
A classic collection of studies of how humans make judgments under (usual) conditions of uncertainty. The authors coined some of the key terms in standard use in behavioral science.

39. Kaplan, H.S., Battles, J.B., Van der Schaaf, T.W., Shea, C.E., Mercer, S.Q. (1998) Identification and classification of the causes of

events in transfusion medicine. Transfusion 38:11-12.
Generally applicable, reliable method for identifying and quantifying transfusion-related problems allowing providers to compare experiences.

40. Kohn, L., Corrigan, J.M., Donaldson, M.S. (Editors, Committee on Quality of Health Care in America, Institute of Medicine). (1999) To Err Is Human: Building a Safer Health System. Washington DC: National Academy Press (available at: http://books.nap.edu/html/to_err_is_human/) This Institute of Medicine report proposes a comprehensive strategy for government, industry, consumers, and providers to reduce medical errors, and calls on Congress to create a national patient safety center to develop tools and systems needed to address persistent problems. Each chapter has a reference list so that readers can select additional material based on specific areas of interest. Emphasizes the need for instituting systems but also underscores the pivotal need for interdisciplinary collaboration and for bridging the traditional "silos" of disparate health care professions.

41. Krueger, N.E., Mazuzan, J.E., Jr. (1993) A collaborative approach to standards, practices. Setting the stage for continuous quality improvement. AORN J 57:467, 470-5, 478-80. Argues that the scope of traditional nurse-physician standards and practices discussions should extend to how systems management influences care quality. Joint documentation, collaborative practice and CQI encourage open discussions of patient care improvements. Offers a Computerized Collaborative Standards and Practices Manual developed and approved by all disciplines to document practice plans.

42. Larson, E., Hamilton, H.E., Mitchell, K., Eisenberg, J. (1998) Hospitalk: an exploratory study to assess what is said and what is heard between physicians and nurses. Clin Perform Qual Health Care 6:183-9. Reviews physician-nurse communication in a hospital undergoing rapid change. Differing perceptions of interactions lead to misunderstanding of motives and meaning. There were shared perceptions of roles in communication processes, such as giving orders, asking for information, asking for or giving opinions, but differing views of physician-nurse roles in giving information, orienting, and providing education. Most physicians thought that nurses initiated certain kinds of communication less often than did nurses. Both hoped for more interaction. Nurses wanted to be "listened to" or respected more and more often wanted to change interactions with house staff than attending physicians. Recommends ways to improve physician-nurse communication, as miscommunication can contribute to errors.

43. Leape, L.L. (2000) Institute of Medicine medical error figures are not exaggerated. JAMA 284:95-97. Counters critical comments by McDonald et al, below. Argues that use of retrospective data from medical records in the IOM Report underestimated, not overestimated error rates and effects. Many errors are never recorded, most surgical procedures occur in outpatient settings, and prospective studies report even higher error rates. Studies cited in the IOM report were not on terminal patients who would have died regardless of adverse treatment effects, contrary to suggestions by McDonald et al. Pleads for less focus on shocking figures and more on redesigning work patterns to prevent errors.

44. Leape, L.L.,, Kabcenell, A. I., Gandhi, T. K., Carver, P., Nolan, T. W., Berwick, D. M. (2000) Reducing adverse drug events: lessons from a breakthrough series collaborative. Jt Comm J Qual Improv 26:321-31. Success in reducing errors was associated with strong leadership, effective processes, and apt choice of intervention. Successful teams defined, clearly stated, and relentlessly pursued their aims, then chose practical interventions and quickly changed processes rather than first spending months collecting data. The most successful were those that attempted to change processes, not people. Health care organizations committed to patient safety need not regard current performance limits as inevitable.

45. Leape, L.L. (1997) A systems analysis approach to medical error. J Eval Clin Pract 3:213-22.
Human factors research shows that most errors arise from defects in work systems. Error reduction requires correcting systems failures, failures in design of process, tasks, training, and work conditions that make errors more likely. Barriers to reducing errors include health care system complexity, limited information access, tolerance of stylistic practices, fear of punishment that reduces reporting, and lack of effective methods to detect and quantify errors in most institutions. Error reduction requires commitments by leadership and recognition that errors are signs of deficiencies in systems, not people.

46. Leape, L.L., Bates, D.W., Cullen, D.J., Cooper, J., Demonaco, H.J., Gallivan, T., Hallisey, R., Ives, J., Laird, N., Laffel, G., et al. (1995) Systems analysis of adverse drug events. JAMA 274:35-43.
Landmark article on systems analysis of adverse drug events, defining underlying problems and identifying the "proximal causes" of medication errors.

47. Leape, L.L., Kabcenell, A., Berwick, D.M., Roessner J. (1998) Reducing Adverse Drug Events: Breakthrough Series Guide. Boston, MA: Institute for Healthcare Improvement
Institute for Healthcare Improvement Guides are based on real-life experiences of health care organizations making dramatic changes as part of a Breakthrough Series Collaborative. Each summarizes goals, results, models to speed progress, successful concepts for change, resources, key contacts, and a bibliography, based on the 1996-97 Collaborative on Reducing Adverse Drug Events.

48. Leape, L.L., Brennan, T.A., Laird, N., Lawthers, A.G., Localio, A.R., Barnes, B.A., Herbert, L., Newhouse, J.P., Weiler, P.C., Hiatt, H. (1991) The nature of adverse events in hospitalized patients: Results of the Harvard medical practice study II. New Engl J Med 324:377-384.
Prevention of many adverse events must await improvements in medical knowledge but the high proportion that are due to management errors suggests that many may be preventable now. Lowering error rates will require identifying causes and developing methods to prevent error or reduce its effects.

49. McDonald, C.J., Weiner, M., Hui, S.L. (2000) Deaths due to medical errors are exaggerated in Institute of Medicine Report. JAMA 284:93-95.
While applauding efforts to understand the reasons for and reduce the frequency of medical errors, these authors criticize what they consider to be exaggerated estimates of medical error rates and consequences in the Institute of Medicine Report (Kohn et al, above). They suggest that error rate estimates were based on biased medical record review studies which failed to consider the likely minimal effects of apparent adverse treatment events on life expectancies of the severely ill patients who were studied, arguments countered in an accompanying commentary by Leape (see above).

50. Nelson, E.C., Batalden, P.B. (2000) Knowledge for improvement:: Improving quality in the micro-systems of care. In Managing Quality of Care in a Cost-Focused Environment, Goldfield, N., Nash, D.N., eds. American College of Physician Executives, Tampa, 75-87.
Describes the process of redesigning health care delivery through development of essential systems to provide and improve care quality while limiting costs, emphasizing organization and team development.

51. Nightingale, P.G., Adu, D., Richards, N.T., Peters, M. (2000) Implementation of rules based computerised : intervention study. BMJ 320:750-3.
Between October-August 1999, an automated bedside prescribing-administration system cancelled 58 (0.07%) out of 87,789 prescriptions on the grounds of safety, and 427 (57%) prescriptions which generated high level warnings; 1257 (8%) which generated low level warnings were not completed. All prescriptions are now complete and legible. There are no transcription errors. The system also assists clinicians when writing prescriptions by making

available information on patients. It supports clinical decision making, improves safety, and has been well received by doctors, nurses, and pharmacists.

52. Nolan, T.W. (2000) System changes to improve patient safety. BMJ 320:771-3.
Systems can be designed to prevent or detect and intercept or, at least, mitigate predictable errors due to characteristics of human cognition. Useful tactics include reducing complexity, optimizing information processing, using automation and constraints, and reducing undesirable effects of change.

53. Nuckles M., Bromme, R. (1998) Knowing what the others know: a study on interprofessional communication between nurses and medical doctors. Klin Padiatr 210:291-6
Doctors' and nurses' assessments of their respective task demands was only partly correct. Doctors did not use nurses' knowledge about patients when venturing prognoses. Education to improve interprofessional communication could help to overcome these deficits. Physician-nurse communication and cooperation should be considered a necessary element of professional competence.

54. Pantaleo, N., Talan, M. (1998) Applying the performance improvement team concept to the medication order process. J Healthc Qual 20:30-5.
A multidisciplinary approach involving physicians, nurses and pharmacists streamlined the medication order process, decreased delays in initiating drug therapy, prevented adverse drug events, enhanced knowledge of providers, was cost-effective, and met patients' and providers' needs and expectations.

55. Pietro D.A., Shyavitz L.J., Smith A.S., Auerbach B.S. (2000) Detecting and reporting medical errors: why the dilemma? BMJ 320:794-6.
Real and perceived motivational errors that influence how errors are handled must be identified, discussed, and changed. Error detection provokes fears and practical problems which must be addressed.

56. Pilpel, D., Schor, R., Benbassat, J. (1998) Barriers to acceptance of medical error: the case for a teaching program. Med Educ 32:3-7.
New curricula on error prevention may be blocked by institutional norms encouraging authoritarianism, intolerance of uncertainty, and denial of error. Acceptance of error is required for candid reporting, and analysis and prevention require reporting. Teaching to promote medical error as both inevitable and reducible makes students realize that peers and instructors share their doubts and uncertainties.
Quality first:: Better health care for all Americans. (1998) Final Report to the President of the United states, The President's Advisory Commission on Consumer Protection and Quality in the Health Care Industry. Washington, DC, 197-211 (Available at: http://www.hcqualitycommission.gov/).Broad recommendations emphasize need for interdisciplinary training of physicians and nurses, educational institutions to provide this, and all health professionals to be trained in quality improvement.

57. Rasmussen, J. (1990) Human error and the problem of causality in analysis of accidents. Philosophical Transactions of the Royal Society of London 327:449-462.
Classic general discussion of human error occurrence as a natural event and methods of analysis.

58. Reason, J. (1990) Human Error. New York, NY: Cambridge University Press.
Classic treatise on error theory by the leading authority. Reviews the literature and establishes a theoretical framework for understanding error, much of it based on his and Rasmussen's work.

59. Reason, J. (2000) Human error: models and management. BMJ 320:768-70.
A short summary of the major work by one of the leading authorities on human error. Rather than the "person approach" focused on blaming individuals for forgetfulness, inattention, or moral weakness, the system approach concentrates on building defenses to avert errors and mitigate their effects in real work settings.

Highly reliable organizations are constantly preoccupied with the possibility of failure.

60. Risser, D.T., Rice, M.M., Salisbury, M.L., Simon, R., Jay, G.D., Berns, S.D. (1999) The potential for improved teamwork to reduce medical errors in the emergency department. The MedTeams Research Consortium. Ann Emerg Med 34:373-83.
Study showing 8.8 teamwork failures/case and that more than half of deaths and permanent disabilities that occurred were avoidable. Prompted an emergency department to teach teamwork skills to improve communication and coordination to reduce error, using concepts from successful aviation programs.

61. Rosner F., Berger, J.T., Kark P., Potash J., Bennett A.J. (for the Committee on Bioethical Issues of the Medical Society of the State of New York) (2000) Disclosure and prevention of medical errors. Arch Intern Med 160:2089-92.
Reviews physicians' responsibilities for disclosure of even minor errors by themselves and others, apologies, and active promotion of error analysis and systems improvement.

62. Schaubhut, R.M., Jones, C. (2000) A systems approach to medication error reduction. J Nurs Care Qual 14:13-27.
Describes an interdisciplinary process for reducing medication errors by expanding the error reporting system with a concurrent chart review and a systems approach to safe administration of medications. Documentation deficiencies fell, a new follow-up process began, and error reporting increased.

63. Selbst, S.M., Fein, J.A., Osterhoudt, K., Ho, W. (1999) Medication errors in a pediatric emergency department. Pediatr Emerg Care 15:1-4.
Nurses were involved in 39% of reported errors and nurses and emergency physicians jointly in 36%. Many were preventable. Families were not told of errors in 1/3 of cases. Effective prevention requires an interdisciplinary systems approach with a change in procedures, organization, and attitudes.

64. Sexton, J.B., Thomas, E.J., Helmreich, R.L. (2000) Error, stress, and teamwork in medicine and aviation: cross sectional surveys. BMJ 320:745-9.
Pilots were less likely to deny effects of fatigue on performance than surgeons or anesthetists. Unlike surgeons, almost all pilots and intensive care staff rejected hierarchies in which senior team members were closed to input from junior members. High levels of teamwork with surgeons were reported by 73% of surgical residents, 64% of surgeons, 39% of anesthesia consultants, 28% of surgical nurses, 25% of anesthesia nurses, and 10% of anesthesiology residents. Only 1/3 of hospital staff reported that errors were handled appropriately, and 1/3 of ICU staff did not acknowledge that they make errors. Over 1/2 ICU staff reported that it was difficult to discuss errors. Barriers to discussion are important because staff deny effects of stress and fatigue on performance. Differing perceptions of teamwork among staff and reluctance of senior staff to accept input from junior members add to problems.

65. Soreff, S. (1990) Quality improvement: a collaborative discipline approach. Psychiatr Clin North Am 13:187-91.
Offers ways to enhance involvement and participation in quality assurance, collaborative approaches, and techniques to promote collaboration. A quality assurance program must function as a collaborative discipline in full partnership with the entire treatment team to achieve true quality improvement.

66. Stead, W.W. (1998) The networked health enterprise. J Amer Inform Assoc 5:412-5.
Review the enormous potential and responsibility of informatics to enable coordinated, high quality, consumer-centered health care.

67. Sullivan, T.J. (1998). Collaboration: A health care imperative. New York: McGraw-Hill Health Professions.Broad discussion of collaboration includes needs to communicate to provide effective, safe care.

68. Teich, J.M., Glaser, J.P., Beckley, R.F., Aranow, M., Bates, D.W., Kuperman, G.J.,

Ward, M.E., Spurr, C.D. (1999) The Brigham integrated computing system (BICS): advanced clinical systems in an academic hospital environment. Int J Med Inf 54:197-208.
This integrated computing system provides results review, longitudinal medical records, provider order entry, critical pathway management, operating-room dynamic scheduling, critical-event detection and altering, dynamic coverage lists, automated inpatient summaries, and an online reference library. It emphasizes direct provider interaction and clinical decision support. Impact studies show significant value of the system in preventing adverse events and in saving costs, particularly for medications.

69. Thomas, E.J., Studdart, D.M., Burstin, H.R., Orav, E.J., Zeena, T., Williams, E.J., Howard, K.M., Weiler, P.C., Brennan, T.A. (2000) Incidence and types of adverse events and negligent care in Utah and Colorado. Med Care 38:261-71.
Confirms earlier studies on incidence and types of adverse events. Iatrogenic injury still is a significant public health problem. Improved surgical care and drug delivery systems could lower iatrogenic injuries.

70. Thomas, E.J., Brennan, T.A. (2000) Incidence and types of preventable adverse events in elderly patients: population based review of medical records. BMJ 320:741-4.
Complexity of care for the elderly makes preventable adverse events related to falls, drugs, and medical procedures, especially common. Interdisciplinary error prevention efforts should target these areas.

71. Thomas, E.J., Studdart, D.M., Newhouse, J.P, Zbar, B. I., Howard, K. M., Williams, E. J., Brennan, T. A. (1999) Costs of medical injuries in Utah and Colorado. Inquiry 36:255-64.
Estimates direct and indirect costs of adverse events based on review of hospital admissions data. Extrapolation to all U.S. hospital admissions indicates $17 billion costs for preventable adverse events.

72. Vincent C., Taylor-Adams S., Chapman E.J., Hewett, D., Prior S., Strange P., Tizzard A. How to investigate and analyse clinical incidents: clinical risk unit and association of litigation and risk management protocol. BMJ 320:777-81.
Error analysis should use formal systematic protocols and focus more on organizations than on individuals, to derive strategies for enhancing patient safety.

73. Weiner, M., Gress, T., Thiemann, D.R., Jenckes, M., Reel, S.L., Mandell, S.F., Bass, E.B. (1999) Contrasting views of physicians and nurses about an inpatient system. J Am Med Inform Assoc 6:234-44. Physicians and nurses had different opinions about effects of a computer-based provider order-entry system on patient care, highlighting the need to consider both perspectives when assessing the impact of new systems. Most nurses saw beneficial effects but many physicians saw negative effects.

74. Weingart S.N., Wilson R.M., Gibberd R.W., Harrison B. (2000) Epidemiology of medical errors. BMJ.2000. Mar 18;320(7737);774-7.
Medical errors result in 44—98,000 unnecessary deaths per year and one million excess injuries in the U.S., and are especially associated with introduction of new procedures, extremes of patient age, complex care, urgent care, and prolonged hospital stays.

75. Welch, D.L. (1998) Human factors analysis and design support in medical device development. Biomed Instrum Technol 32:77-82.
Reviews human factors engineering analysis and design undertaken to develop new systems. "Root causes" of accidents are often labeled "human errors" to explain away system-wide problems. Human factors analysis is effective in designing and operating systems that consider human weaknesses and do not "set up" users to commit errors. "Fault tolerant" systems can be designed, so errors are harder to commit and easily detected, corrected, and mitigated. Human factors engineering can be used to develop new systems to enhance safety, efficiency, and usability, evaluate whether to purchase equipment and how to integrate it into hospital systems; and investigate accidents.

76. Welch, D.L. (1997) Human error and human factors engineering in health care. Biomed Instrum Technol 31:627-31.
Explores the nature of human error and how human factors engineering can reduce rates and effects of errors. Human error is inevitable in complex systems including health care. Human factors engineering has dealt with human error since the 1940's, originally in design of complex military aircraft cockpits, nuclear plants, NASA spacecraft, the process control industry, and computer software. As analyses went beyond "pilot error" to explain how cockpit designs led to crashes, the health care industry is defining causes of significant human errors and developing ways to eliminate or ameliorate them.

77. Williams, K.A., Rose, W.D., Simon, R. (1999) Teamwork in emergency medical services. Air Med J 18:149-53.
Outlines analyses of medical errors related to individual and team performance. Introduces concepts related to teamwork and team training. Errors in medical care typically are blamed on individuals and occasionally on system problems, but teams and teamwork, though major parts of medical delivery systems, seldom are included in training, outcome measures, or quality improvement efforts. By analogy with aviation, analysis and error- reduction efforts is being implemented in health care.

78. Witman, A.B., Park, D.M., Hardin, S.B. (1996) How do patients want physicians to handle mistakes? A survey of internal medicine patients in an academic setting. Arch Intern Med 156:2565-9.
Patients want acknowledgment of even minor errors. Doing so may lower risks of punitive lawsuits, reinforcing the value of open communication between patients and health care providers.

79. Wu A.W. (2000) Medical error: the second victim. BMJ 320:726-7.
Briefly discusses the usually dysfunctional reactions of physicians who have made errors, the frequent lack of support from colleagues, the adverse effects of these patterns on both individual physicians and error prevention efforts, and the need for a supportive environment.

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